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The Protection of Vital Corporate Records

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A program is outlined for the protection of vital corporate records against the effects of catastrophe. The various types of records are classified, principally according to balance sheet classification, and the specific procedure for each type described. A summary of the procedure for both accounting and other records is included.

THE STRONG BOX, safe and bank vault have become the traditional symbols of protection for valuable papers. Some twenty-five years ago, microfilming was introduced in banks to provide a photographic record of customer check transactions, which gave these institutions protection against fraud and also made it possible for the banks to reduce the time required to process checks.

Since then, the use of microfilming has advanced and has been included among the methods of protecting vital records. The description of methods used at Eastman Kodak Company, contained in this article, may suggest ideas of general applicability for a program of protecting vital records. Such a program, may likewise streamline time-consuming procedures. The scope of Kodak's problem in this respect may be indicated by pointing out that, in Rochester, the company has five manufacturing plants and an office division housing sales, distribution, and administrative groups.

Preservation Policies; Adopting an Index System for Films

Management has delegated responsibility for continuous supervision of the records-protection program to a committee composed of representatives from the major divisions of the company. In order to determine what records are essential, production men, engineers and other specialists are consulted.

SUMMARY OF RECORDS INCLUDED

COMPTROLLER'S OFFICE EMERGENCY RECORD PRESERVATION PROGRAM

RECORD	FORM IN WHICH STORED	DEPOSITORY	ADDITIONS	DEPOSITORY COPIES MAY BE DESTROYED
Capital Assets Ledger Cards	MI	a	6	Semi-Annually
Cash Receipts Book	PH	b	3	Quarterly
Comptroller's Office Reports	MI	a	6	Indefinite
General and Analysis Ledgers	MI	a	5	After One Year
Gross Profit Working Papers (Summary)	PH	b	6	Semi-Annually
Journal Entries	MI	a	3	Not to be Destroyed
Pricing Data (Rules for Pricing)	MI	a	7	Not to be Destroyed
Profit and Loss Statements, balance sheets and supporting schedules:				
Book of Accounts	PA	b	6	Not to be Destroyed
Working Papers	MI	a	5	Not to be Destroyed
Quarterly Priced Inventories	MI	a	5	Quarterly
Reconciliation of Bank Statements	MI	a	5	After One Year
Renegotiation Data	MI	a	6	Indefinite
Reserve for Processing (Summary and Procedure)	PH	b	5	Quarterly
Standard Procedures	PA	b	8	When Revised
Accounts Receivable Ledger Cards	MI	b	5	After One Year
Remittances	MI	b	1	When Accts. Rec. are Remicrofilmed
Disbursements	MI	a	1	Indefinite
Billing Information	MI	a	7	Indefinite
Finished Goods Inventory	MI	b	5	Quarterly
Price Lists, Net and List	MI	a	7	Indefinite
Production, Sales, and Shipments	MI	a	7	Indefinite
Quarterly Inventory	PA	b	5	Quarterly
Weekly Production and Shipments	PA	b	1	When current Quarterly Inventory is stored
Master Deck Run of Payroll	PA	b	3	Each Period
Summary of Payroll	PA	b	2, 3, 5	2 & 3 When Current Pd. is Stores, 5, After, Five Years
Earnings Record Cards	MI	a	9	After Two Months
Daily Posting Sheets (Dom. and For. Dealers)	PA	b	1	Quarterly
Invoice Registers	PA	b	1	Quarterly
Period Posting Sheets (Foreign Subs. and Br.)	PA	b	3	Quarterly
Period Sales Reports	PA	b	3	Annually
Credit for Foreign Taxes Paid	MI	a & b	5	Not to be Destroyed
Internal Revenue Agents Reports	MI	a & b	5	Not to be Destroyed
Tax Reminder File Cards	MI	a & b	5	Five Years
Tax Returns over $10,000, Including Schedule Excise Tax Return (A Part of Above)	MI	a & b	5	Some 6 Yrs. Some never
	PH	b	4	Quarterly
OTHER ADMINISTRATIVE GROUPS COVERED BY THIS PROGRAM				
ADVERTISING				
Record of Advertising Materials Supplied to Dealers and Non-Dealers	MI	a	7	Annually
COMPENSATION AND CLAIMS				
Accident Report Sheets	MI	a	6	After Five Years
Individual Case Payment Cards	MI	a	5	Quarterly
Receipts Signed by Employees	MI	a	4	After Seven Years
EMPLOYEE'S BENEFITS				
Employees Accounts Receivable Ledgers and Notes	MI	a	4	After Two Months
Life Insurance and Annuity Policies	MI	a	7	Annually
Personal Records of Employees in Safekeeping	MI	a	4 & 7	Annually
Record Cards	MI	a	3 & 7	Annually

EXHIBIT 1

Included, in addition to accounting records, are plans of buildings and utility services, special machine designs, research data, write-ups of production techniques, formulas, etc. The committee decided that the following policies would be applied in record preservation:

1. To warrant retention, a given record be required to determine the financial value of an asset which might remain after a catastrophe, to arrive at the amount of the loss suffered, or to have available data essential to rebuilding the plant or any part of it lost in a catastrophe.
2. The cost of the emergency record preservation must be kept as low as possible.
3. The film and paper copies of the record to be kept, must be sent to several out-of-town locations. The availability of the best type of storage space for the particular record and the adage of not putting "all of one's eggs in one basket" were the prime reasons for this dispersion of the records.

Summary of Records Included (Continued)

RECORD	FORM IN WHICH STORED	DEPOSITORY	ADDITIONS	DEPOSITORY COPIES MAY BE DESTROYED
INDUSTRIAL RELATIONS				
Kodak Handbook	PA	b	8	When Revised
Occupational Titles and Code	PA	b	8	When Revised
Standard Industrial Relations Procedure	PA	b	8	When Revised
INSURANCE				
Insurable Assets	PA	b	6	Semi-Annually
List of Insurance Policies in Effect	PH	b	7	Annually
LEGAL				
Certificates of Authority	MI	a	4	Indefinite
Contracts and Similar Documents	MI	a	4	Indefinite
Deeds and Leases	MI	a	4	Indefinite
Minute Books of E. K. Co. of N. J.	MI	a	5	Indefinite
Stock Certificates of Sub. Cos.	MI	a	5	Indefinite
Miscellaneous Agreements, Assignments, Special Files and Releases	MI	a	4	Indefinite
MATERIAL STANDARDS				
Standards, Specifications, Test Methods, and Inspection Procedures	PA	b	8	When Revised
PATENT				
Applications Pending on Patents	MI	a	9	20 Years from Date
Applications Pending on Trade Marks	MI	a	9	Indefinite
Copyright Certificates	MI	a	9	54 Years from Date
Interferences	MI	a	9	20 Years from Date
License Agreements	MI	a	9	Indefinite
Original Grants of Patents Including Inventors Assignments of Patents	MI	a	9	23 Years from Date
Original Grants of Trade Marks	MI	a	9	Indefinite
Patents Licensed to Us - Printed Copies	MI	a	9	23 Years from Date
Sketch Sheets and Inventor's Reports Not Acted Upon	MI	a	10	Indefinite
Applications	MI	a	3 & 7	Annually
Job Descriptions	MI	a	-	Not to be Destroyed
Job Evaluation Run	PA	b	6	Semi-Annually
PUBLIC RELATIONS				
Annual Reports	PA	b	7	Not to be Destroyed
SALES				
Contracts Register of Government Div.	MI	a	5	Quarterly
Dealer Records	MI	a	6	Semi-Annually

KEY TO ABBREVIATIONS

1. Daily
2. Weekly
3. Periodically
4. Monthly
5. Quarterly
6. Semi-Annually
7. Annually
8. As Issued
9. Bi-Monthly
10. 4 to 6 Weeks

MI Microfilm
PH Photostat
PA Paper
a Out-of-town bank
b Out-of-town company location

PART 2 — EXHIBIT 1

It was also necessary at the start to devise a plan for making the information on the films "locatable" at need. Accordingly, in each plant, representatives of the comptroller's office work with representatives of departments to set up an integrated filing system. For example, using the Dewey Decimal System well-known to libraries, one manufacturing plant used the following system for its microfilm rolls:

Division A	00.00 to 09.99	Research	50.00 to 59.99
" B	10.00 to 19.99	Comptrollers	60.00 to 69.99
" C	20.00 to 29.99	Industrial relations	70.00 to 79.99
" D	30.00 to 39.99	Purchasing	80.00 to 89.99
Plant service	40.00 to 49.99		

Further extension of the above classification may be illustrated by the plant comptroller's division, which is divided into the following groups for index purposes:

Time and payroll department	60.00.00 to 60.99.99
Wage standards department	61.00.00 to 61.99.99
Industrial engineering department	62.00.00 to 62.99.99
Accounting department	63.00.00 to 63.99.99
Miscellaneous	64.00.00 to 64.99.99
Available (unused numbers)	65.00.00 to 65.99.99

In other words, each division may be divided into as many as ten departments and each department may classify its material under 100 separate headings and can use 100 roles under each heading.

The Microfilming Program Related to Current Assets

The comptroller's division started with the balance sheet as a guide to the work to be covered and the plan of this article follows, in general, balance sheet order, in recounting the records which were microfilmed or, in some cases, specifically left out of the program.

It should be mentioned, before going down the balance sheet categories, that we have sent to an out-of-town company location carbon copies of the complete formal semi-annual accounts and a microfilm of our working papers for each quarterly closing. These, of course, are in considerable detail and would supply us with a starting point in reconstructing our accounts to the date of disaster. Exhibit 1 comprises a summary of the principal records sent to one or more safe depositories. Details as to the form, depository, frequency of sending to the depository and recommended dates for destruction of the original records are explained. In many cases, much valuable storage space has been saved by early destruction of original records and permanent retention of the microfilm copies.

The disbursement side of cash may be treated first. Prior to the microfilming program, each check (written in the main office disbursements department from lists prepared by the various plants) was transcribed into a disbursement record with the check number, date, payee, and amount being given. It took a clerk twelve hours a week to prepare this form. Then, the disbursement record was used to check off the checks returned by the banks, as part of the reconciliation of the bank balances. When the program was started, it was decided to discontinue this record and to microfilm carbon copies of the checks as a permanent record of the checks written. The carbon copies of the checks are kept in numerical sequence until they have been microfilmed. Then the carbons are sorted against the returned checks and the copies of those returned are destroyed shortly thereafter, while the carbon copies of the checks not returned constitute the total of the outstanding checks in reconciling the bank balance. Each day, therefore, the carbon copies of the checks written are microfilmed and the microfilms are mailed daily to an out-of-town depository.

As to cash receipts, incoming remittances have been microfilmed for years as

a convenient reference for "look-ups" of checks which were incorrectly applied or where other questions arose which could be determined only by referring to a copy of the checks. The original, of course, had been deposited. A duplicate film of these remittances is now sent to an out-of-town depository every day.

Thus, we have a daily record of both incoming and outgoing cash items on file in an out-of-town depository. Every three months, the bank reconciliations are microfilmed, so that only the period from the last quarter to the date of a disaster would need to be reconciled to the bank's records. The records of cash movements get prior attention because they are probably more current and complete than any other asset. Not only do they provide information on cash balances but also on many other assets and liabilities.

Investments are a different matter. With respect to marketable securities, the carbon copy of the semi-annual typed accounts or the microfilm of the quarterly working papers gives us a starting point. The movement of the cash account on film in a safe depository would enable us to reconstruct the new balance, together with the possible assistance, if required, of out-of-town financial houses through whom securities may have been purchased or sold.

As applied to accounts receivable, the program is carried out by microfilming all our customers' ledger cards, together with a quarterly reconciliation of the accounts in total. In order to keep our records current between quarters, our tabulating department prepares carbon copies of the scrolls of daily total dollar sales by customers, run from the punch cards of the sales tabulation. These daily posting scrolls would enable us to reconstruct the charges to each customer's account and the data on the microfilm record of incoming cash permits us to determine the total credits to be applied. The daily carbon copies of the posting scrolls are mailed to an out-of-town division for safe-keeping.

Inventories of finished goods in our distribution center and domestic branches are taken quarterly on standard preprinted inventory sheets. Each location is designated by a color band at top and bottom of the sheet. The originals are forwarded to the comptroller's section of the distribution center, where they are shingled and the quantities cross-footed and totals entered on a summary sheet. The summary sheets are then forwarded to the general comptroller's office, priced and extended.

The extended summary sheets are microfilmed, thus preserving the inventory record of finished goods for the entire company. Unpriced copies of the original inventory sheets are kept at each location. If the records of only one location were destroyed, the values for that location at the end of the previous quarter could be obtained from the summary of the inventory records, by determining the difference between the original microfilm record and the summary

of the other branches. If the records of more than one location were destroyed, it would be impossible to reconstruct values accurately by location. However, at any interim period end, they could be approximated for the company as a whole.

Weekly tabulations are also preserved of our distribution center shipments to domestic and foreign branches, in terms of units by product class. Periodic summaries of dollar sales and shipments are microfilmed and sent to an out-of-town depository.

With respect to in-progress inventories, it was decided to save expense by microfilming cost ledgers on a quarterly basis. Copies of closing papers of the various plants are sent quarterly to an out-of-town depository. No attempt is made to preserve detailed records of labor, material and overhead added to specific product cost accounts during each accounting period. However, it is possible to reconstruct an overall picture of the in-process values for the local plants as a whole. The total labor and material cost would be obtained from disbursement records on film, estimated overhead would be applied and the total added to the microfilm inventory of the previous quarter. From this total, the value of production based on weekly tabulations of units of production by product class could be subtracted.

The Microfilming Program Related to Capital Assets

Our capital asset records consist of individual cards, one for each asset or a unitized group of assets. These cards are summarized in ledgers by class of assets. Semi-annually, the individual asset cards are microfilmed for protection purposes. The ledger accounts show totals by years, plus depreciation periodically and to date. No duplicate or other record is kept of the asset ledgers mentioned above, because they could be reconstructed from the individual asset records on film.

The system for interim records of capital additions varies somewhat, according to the problems of the individual plants. One plant, for example, sends a copy of each shop order for new assets to a safe depository as soon as it is prepared. Each accounting period, a copy of the trial balance of work-in-process by shop order is sent to the same designated depository.

The Microfilming Program Related to Liabilities

No concerted effort is made to keep details of current liabilities. If ever necessary, our suppliers could furnish duplicate invoices and, of course, our records of outgoing cash tell us which bills have been paid. The information on

the film copies of our checks would enable us to establish very readily a fairly complete list of the venders with whom we deal regularly.

Liability to our stockholders is a problem for our transfer agents and registrar. They, too, have taken steps to protect their lists of stockholders against possible disaster. However, the registrar is sending daily to one of our out-of-town locations a carbon copy of the changes in the list of stockholders. We also have, in the same location, a complete list of stockholders and their holdings quarterly, which is prepared at the time the dividend payment is made.

Journals, Ledgers and Underlying Payroll Records

Our company uses pre-numbered journal voucher forms. These consist of the voucher plus any supporting schedules or detail. They represent the very heart of our entire accounting system and, because of their importance, had been saved since the beginning of the company. In our main office, we use about a thousand vouchers a year. The vouchers vary from one to a hundred sheets of paper. Over the years, they have represented a considerable storage problem, both as to finding space and as to keeping the file intact.

Rather than having highly paid employees spend considerable time trying to decide which vouchers to save and which to destroy, all of our journal vouchers from the beginning to the present were microfilmed. The original films of all the journal vouchers are filed in a single filing cabinet in our accounting department. Duplicate rolls of film were made for permanent storage in an out-of-town depository. All of our older journal vouchers were destroyed and considerable space saved in our record room.

As a current matter, journal vouchers are microfilmed shortly after they are prepared, so that, if the originals are ever lost, the exact copies may be viewed by placing the microfilm on film readers. Incidentally, it is easier and quicker for filing clerks to locate any particular voucher on the film than to search through many cabinets in the record room.

Our ledgers are photographed quarterly on 35 mm microfilm rather than 16 mm microfilm used for the other records. This gives us current records of our ledgers, where all of the journal entries are summarized.

Pay roll records have been given considerable attention for obvious reasons. In the event of a disaster, we would want a complete up-to-date record of our employees, including their home addresses, status under company insurance programs, job descriptions, social security status, earnings for the year to date, etc. The wages of employees paid on a weekly basis have been computed and summarized by means of punched cards. These cards, together with the master

deck giving the essential data on the employees, enable us to secure mechanically carbons of scrolls each pay period, giving all of this essential information. These carbons are sent to an out-of-town depository.

In addition, it is now standard procedure for copies of accounting procedures, wage standards, etc., to be supplied to an out-of-town depository.

Where to Store Films, Their Authenticity, Program Cost

The matter of selecting locations for the films is one of balancing considerations. In scattering our records to several out-of-town depositories, consideration was given to a number of aspects of the problem. In general, the microfilm records, being compact, are stored in safe deposit vaults of banks in towns near Rochester. Here they are available for use near Rochester should disaster strike directly in the city. The bulkier records such as carbon copies, tabulating scrolls, etc. are usually sent to one of our own distant properties where storage space is available.

There is an important legal angle to a microfilming program. The microfilming of records for an emergency preservation program or for purposes of regular records retention should be carried out in strict accordance with procedures outlined by counsel. This is necessary in order that the authenticity of the film copy may be readily established.

Cost also bears on whether and to what extent to undertake microfilming. The cost of such a program will vary with the size of the company and the problems encountered. Therefore, a statement of our cost would be of no value here. However, from our experience, we believe that such a program as we have adopted is well worth while and that the cost can be kept low if the program is properly applied. The carbon copies of the accounts, scrolls, etc. represent little additional labor, while, in many instances, the microfilming is done by employees as a part of their regular duties. In the case of the remittances made to others and checks received from customers, employees in our mail department run an entire day's cash receipts through a microfilmer in a few minutes.

Despite the apparent stalemate on the Korean battlefront, the international tension still exists. In our opinion, this tension, plus the possibilities of loss of vital records from fire, floods, explosions, etc. warrants a continuing review of the best means of protecting these vital records. It is the accountants' responsibility to see that the accounting records are available whenever they are needed —and the need may be greatest when a catastrophe strikes. Hindsight cannot produce a single record which has been completely destroyed.

Production Unit Accounting for Department Stores

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Department store expenses should be broken down into cost centers along functional lines and then evaluated in terms of the work done in the various centers rather than in terms of relationship to sales. Efficiency is thus analyzed in terms of work load productivity rate, and pay rate. Examples of how this may be done are given and the application of production unit accounting to budgeting and comparison of results with other stores noted.

DEPARTMENT STORES, in recent years, have not attained the profit levels realized by business as a whole. The national net retailing profit of 2.3 per cent on sales reported for 1951 is evidence of the need for serious efforts in cost finding and cost reduction. For these objectives, accounting can supply the required facts, provided the methods are designed to do the job at hand.

As incentive to this, it is a hopeful sign that department stores are beginning to recognize that it is high time their accepted accounting procedures received a complete modernization. For the last decade, the department store has experienced increasing competitive pressure from other forms of distribution. The drug store, specialty shop, and the appliance store have made great strides in the merchandising field. The success of these assorted enterprises in competing with similar units of the department store has not been due only to pleasant, well-trained, and intelligent sales personnel. Behind the scenes, we are likely to find an individualized accounting control which holds expenses in desired relationship to volume, avoids undue costs, and promotes continued efficiencies.

A counter attack along accounting lines is in the making. Department store accounting generally reflects the procedures set forth in the manual developed by the National Retail Dry Goods Association in 1917, and revised in 1922 and in 1928. The weaknesses of these procedures have become increasingly apparent. Accordingly, the N.R.D.G.A. is preparing a complete revision of its manual for issuance in the near future. The new manual will contain changes and recommendations aimed at:

1. Coordination of expense control with lines of authority through establishment of cost centers.
2. The pin-pointing of controllable expenses.
3. Provision for intelligible historical data as a basis for budgetary control.
4. The use of production unit costs in place of the misleading "percentage of sales" for control of expense levels.

It is the last feature, production units costs, which will be discussed in this paper. Since there will be a rapid recognition of the value of this new concept on the issuance of the revised manual of the N.R.D.G.A., department store accountants should be familiarizing themselves with it. They should be thinking in terms of its application to their particular business, how it can be helpful to the management in controlling costs and improving competitive position. They must be laying plans to assure its adoption with a minimum of confusion. First of all, they must become familiar with the work center idea.

Functional Expenses and Units of Measuring Them

Reduced to its simplest terms, expense is the cost of doing a job. It is what we pay for what we get. In order to properly understand our expenses, we must break down store operation into the various kinds of jobs performed, such as floor cleaning, window trimming, waste-paper baling, customer statement billing, elevator operation, and all the other tasks entailed in department store operation. It has been estimated there are about eighty of these jobs in a large store and probably as many as sixty in a medium sized store. The job itself becomes a work center, not necessarily identified by a specific geographical location but as a series of activities which, taken together, produce a definite function within the retailing job.

The production unit selected as a measure of a work center's productivity must have certain characteristics. These are:

1. It must be simple.
2. It must be capable of accurate determination or count.
3. It must be constant in value from period to period.
4. It should not require weighting.
5. It should be common to all department stores to facilitate comparability.

The following is a partial list of usual department store work centers, given here to illustrate the type of units proposed for the measurement of productivity within the various store work centers:

Work Center	Unit of Measurement
Sales audit	Gross sales transactions
Accounts payable	Invoices paid
Payroll and timekeeping	Pay checks (or envelopes) issued
Accounts receivable	Gross credit sales transactions
Retail selling (by departments)	Gross sales transactions (by departments)
Cleaning	1000 sq. ft. selling space X no. of days
Alteration department	Garments handled
Parcel post department	Packages handled

Data Developed Under Production Unit Method—and a Comparison

With the work center idea identified and exemplified, the question is how to use it to solve the department store problem of economical operation. We must know what factors cause costs to rise or to fall within cost centers. Then we can exercise expense control and take steps toward expense reduction. These factors appear to be:

1. The work load—the amount of work to be done.
2. The productivity rate—the speed at which the work is done.
3. The pay rate—the cost per hour of doing the work.

The interplay of these three factors determines the expense level. Therefore, control and reduction of expense can be accomplished through keeping them in proper relationship. This is the objective of production unit accounting.

In this presentation of production unit accounting, a single work center, sales audit, will be discussed. This center provides the store with a complete analysis of its sales by department, by type and by sales person, and furnishes information to the general accounting office for recording of accounts receivable and cash receipts.

Under the present standard expense accounting system, the management would be informed that its sales audit costs were $6,000 for 1952. If the store's sales volume was $6,000,000, the sales audit cost would be presented in this fashion:

Sales audit $6,000 .1% to sales

This is informative to the extent that $6,000, or one tenth of one per cent of sales was expended to perform the function of auditing the sales transactions. It does not show whether $6,000 was too much in relation to the work produced or how much work was produced.

The production unit accounting method begins with the measure of the units of work. Perhaps we find that 1,500,000 sales tickets and credits were processed through the auditing section. Therefore, we establish the first factor in production unit accounting, the work load. The first step in the expense control now shows:

$$\frac{\text{Labor Cost}}{\text{Work load}} = \frac{\$6{,}000}{1{,}500{,}000} = \$.004, \text{ the Transaction cost}$$

The second factor, productivity, is measured by the work load divided by the hours worked and, upon determining the total hours represented in the sales audit payroll, we find:

$$\frac{\text{Work load}}{\text{Hours worked}} = \frac{1{,}500{,}000}{5{,}333} = 281.2 \text{ Transactions per hour}$$

The third factor obtained for our sales audit work center is the average pay rate, the quotient of the labor cost divided by the hours worked:

$$\frac{\text{Labor cost}}{\text{Hours worked}} = \frac{\$6{,}000}{5{,}333} = \$1.125 \text{ Average pay rate}$$

All facts regarding the sales audit work center are now available, as follows:

Year	Work load	Productivity	Average pay rate	Transaction cost
1952	1,500,000	281.2	$1.125	$.004

In these facts, it is possible to show why production unit accounting is an important management tool. Assuming that management desires a comparison between 1951 and 1952 sales audit costs, the information available by the present standard expense system is:

Year	Sales audit cost	Sales volume	Sales audit cost (Per cent to sales)
1951	$5,500	$5,000,000	.11
1952	6,000	6,000,000	.10

From the information given, management would infer that the cost of sales audit has been reduced some 9 per cent in 1952 and that a good cost reduction job had been done. But let us examine the figures produced by production unit accounting methods:

Year	Work load	Hours Worked	Productivity	Average pay rate	Transaction Cost
1951	1,392,400	5,200	267.8	$1.057	$.00395
1952	1,500,000	5,333	281.2	1.125	.004

It will be noticed that the apparent 9 per cent cost reduction as reflected under the standard expense system has been replaced by a small increase in transaction cost from $.00395 to $.004. When management is given accounting statistics which are as much as 9 per cent in error for the purpose at hand it cannot be expected to produce profits which are in line with those of businesses which are better informed.

Expanded Analysis of Operating Results

The answers which management can obtain from accounting statistics are of very great importance. What answers did management get from the standard expense system comparison of 1951 and 1952 sales audit costs?

Q-1. Why do we have an apparent 9 per cent reduction in sales audit expense?

A-1. The audit labor cost increased about 9 per cent ($500 ÷ $5,500) and, with this 9 per cent increased labor item, we handled a 20 per cent increase in sales auditing $1,000,000 ÷ $5,000,000). In other words, our ratio of cost to sales dropped and we, therefore, have an expense reduction, presumably from an increase in productivity.

Upon the basis of the information available, this answer is reasonable. But, unfortunately, it was a blind question, asked in the light of inadequate and unparticularized information. Under the production unit accounting figures as outlined, the questions and answers would be along the following lines:

Q-1. Why do we have an apparent increase in sales audit expense?

A-1. The average pay rate increased about 6.4 per cent ($.068 ÷ $1.057) due to the 5 per cent general pay increases made to store employees in March, 1952, with approval of the Wage Stabilization Board and the balance is due to the incentive pay system inaugurated in July, 1952, in sales audit section. The incentive pay system has already increased the productivity in sales audit section, as reflected in the 5 per cent increase (13.4 ÷ 267.8). It is anticipated that 1953 productivity will show an 8 per cent increase over 1951, thereby cancelling out the cost of the incentive pay system.

Q-2. Despite a 20 per cent volume increase we had about 8 per cent increase in the number of transactions (work load). To what might we attribute this change in the size of the average sale?

A-2. During the middle months of 1951, we had an overstocked inventory condition which we liquidated through mark-down sales. Our 1951 mark-downs were higher than normal, and those inventory reduction sales produced smaller than normal tickets. However, some credit for 1952 larger average tickets must be directed to the training program in which we are emphasizing the value of "companion sales," quantity purchases in certain lines of merchandise, and some plain old-fashioned salesmanship. We feel that results are beginning to come and are showing in the higher average ticket.

In this way, productivity accounting statistics maintained by work centers on a monthly basis will provide constant knowledge of costs of store operation, affording opportunities to control expenses before they get out of hand. It is actually an accounting method which permits store management to set up standard costs for different work centers, somewhat similar to factory standard cost systems but without the necessity of accounting for standard cost variances.

Improved Budgeting

As an aid to store operating budgets, the production unit accounting system is invaluable. In the average department store, payroll represents approximately 60 to 65 per cent of the store's variable expenses. The breakdown of a variable of such size into some eighty work centers permits budgets having greater accuracy and flexibility. Suppose it is desired to budget the sales audit work center

for 1953. It is known that sales volume in 1952 was $6,000,000 represented by 1,500,000 individual sales transactions of $4 average amount. The 1953 budget is set at $6,250,000 sales. The average sale is estimated at $3.97 an increase of 2 per cent in productivity anticipated. A probable 3 per cent increase in wage rates is allowed for. The budget will appear this way:

1953 Budget - Sales Audit

Work load	Productivity	Average pay rate	Transaction cost
1,574,300	286.8	$1.159	$.00404

There is an advantage with the production unit accounting method in that, regardless of fluctuation in the work load, it is possible to maintain control of the sales audit expense (for example) by continually checking the productivity rate of 286.8 transactions per hour and by watching the average pay rate to keep it within the $1.159 budget. The factors of productivity and average pay rate are easily controlled on a weekly or monthly basis, taking into consideration the variations due to employment factors like vacations, bonuses, sick leave, overtime, etc., which are seasonal, and are readily budgeted upon experience from past years.

Better Comparisons Between Stores

Comparisons are becoming recognized as necessary and desirable in store control. Suppose that two stores, located in different cities, desire to exchange information relative to the sales audit function, under the present expense system, the stores' figures for comparison would appear like this:

Store	Year	Sales volume	Sales audit costs	Sales audit cost (per cent to sales)
"A"	1952	$6,000,000	$6,000	.10
"B"	1952	$7,500,000	$6,500	.087

The controllers, without careful investigation of all facts, would assume that Store B was doing the better cost control job. Its method of audit would be examined for clues to its lower audit costs.

However, a comparison of the figures supplied by production unit accounting shows the following:

Store	Year	Work load	Hours worked	Productivity	Average pay rate	Transaction cost
"A"	1952	1,500,000	5,333	281.2	$1.125	$.004
"B"	1952	1,704,550	6,556	260.0	$1.066	$.0041

With comparisons now based on comparable cost factors, it is learned that Store A is doing the better job in sales audit. The volume handled by Store B, although lower in cost percentage to sales volume, is higher in cost per transaction, due to lower productivity which is not offset by the more favorable average pay rate experienced by Store B.

The search would be diverted now to A's audit operation. How can A, paying 6 per cent more average hourly rate, obtain a lower transaction cost through productivity? If B could increase its productivity to 280 transactions per hour by using A's methods, B would show a transaction cost of only $.0038, which is a potential saving of about $500 annually. If a similar saving could be obtained from each of the sixty different work centers in Store B, it would permit Store B a considerable increase in profits. Production unit accounting makes this potential saving available through intelligent accounting analysis within work centers.

Relative Work Load Idea Makes Data Easier to Use

It is readily apparent that, in talking in terms of unit costs such as $.0041 and $.0038 in the foregoing calculations, the smallness of the figures is a disadvantage. Another disadvantage is that department store managers are accustomed by training and experience to expressing expenses as percentage of sales. In order to overcome both disadvantages, it is proposed that the work load units may be a measurement which represents the amount of work required to produce a unit of $100 of sales. This is called the relative work load, since it is the work load in relation to each $100 unit of the total sales volume.

Upon the basis of relative work load units our 1952, sales audit figures now appear in this manner:

Relative work load	Productivity	Average pay rate	Relative unit cost
60,000	11.25 units/hrs.	$1.125	$.10

Each relative work load unit costs ten cents and, since it represents $100 of sales volume, the cost of sales audit is one tenth of one per cent of sales. If the cost of audit per transaction is desired for internal control purposes, the ten cent relative unit cost is divided by 25 (1,500,000 ÷ 60,000 units) and we have four tenths of a cent, as previously obtained.

The relative work load unit device is effective for control purposes, since it permits controllers to watch the trend of expenses by individual work centers, in relation to sales trends. The productivity rates and average pay rates can be

charted by weeks, months, or by seasons. Any evidence of weaknesses in the work center's expense control will be promptly detected and the effects of any efforts directed toward expense reduction will be immediately noticeable.

A Pending Change

The committee appointed by the Controllers' Congress of the N.R.D.G.A. to prepare a manual covering the operational details of production unit accounting, has held several discussion forums among controllers and owners. All efforts are being directed toward an early introduction of production unit accounting methods to stores. Just how far into the total expense problem the new method will be scheduled to go is not known at this time. However, it is generally acknowledged that department store expense is directly related to productivity. Therefore, primary recognition will be given to the production unit accounting method as applied to work centers within the store.

This change in accounting methods brings to the department store all the benefits now enjoyed by factories from their standard cost accounting. Since it will make possible a more intelligent analysis of store expenses, it will assist in meeting the challenge to recapture a more normal portion of business profits.

Preparing Effectively for Renegotiation*

by C. RICHARD GUNZER

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The theme of this paper is careful planning for renegotiation by meticulous review of the sales and costs which are to determine renegotiable income. The facts which should be gathered to support both the admissable cost elements and the allowable profit are noted and the importance of anticipating questions which may be raised during the renegotiation process emphasized.

THE RENEGOTIATION ACT of 1942 was the first attempt by the United States Government to limit profits of its defense contractors on an overall basis. The step enabled the Government to reclaim excessive profits earned from defense business after the year's operations had been completed and costs and profits have been established. In the successive acts, coverage has been stated in terms of an amount of gross contract revenue beyond which a contractor's profits from this type of business becomes subject to review. Under the Renegotiation Act of 1951, this figure is $250,000. Under the predecessor law, the Renegotiation Act of 1948, it was $100,000. The Renegotiation Act of 1942, which covered World War II years, started renegotiation at $500,000. It should be noted, however, that brokers, agents, etc. are subject to renegotiation under present law if they take in over $25,000 a year.

Renegotiable Business

The question as to what constitutes defense business is, in itself, a lengthy subject and it will not be possible to do more than to touch upon it in this paper. For purposes of present renegotiation, let us keep in mind that defense business consists of all amounts received or accrued from prime contracts entered into with the Army, Navy, Air Force, or with other government agencies designated by law, since January 1, 1951. All related subcontracts are likewise included.

Segregation of renegotiable from nonrenegotiable sales is one of the more difficult tasks in the renegotiation procedure. It is perhaps the most important

* As this paper goes to press, The Renegotiation Act of 1951 has expired, as of December 31st, 1953. However, Congress is scheduled to consider the Act's extension in January. The principles and suggestions contained in this paper are pertinent to renegotiation, in whatever form the Act may be extended and, of course, apply to all open years for some time to come.

consideration in a business which sells a product having both civilian and defense uses. A wide variety of methods are used by industry in establishing renegotiable sales. These include direct inquiry of customers, analyses of purchase orders to identify military contract numbers, CMP symbols, etc.

In connection with determining renegotiable business, there are two principal kinds of exemptions provided for under the Renegotiation Act of 1951, mandatory and permissive. The mandatory exemptions are well-known. The permissive exemptions are contracts which the Renegotiation Board, under its discretionary powers, has exempted. They include contracts for building maintenance or repairs, contracts for the sale or rental of existing real estate, subcontracts for stock items not especially purchased for government contracts, packaging materials and containers, safety equipment and clothing, general office furniture and equipment, and sundry other items.

It is important for everyone to be alert to the possibilities of eliminating sales from renegotiable business which might, without special inquiry or investigation be classified as renegotiable. In some instances, this special effort can take the form of reminding the customer, when replying to your written inquiries, that purchases made for stock, regardless of ultimate usage for defense, are not to be classified as renegotiable. A situation might arise under which a company undertakes machining, grinding, or stamping certain small tooling for a customer whose present products are largely going into defense channels. Upon investigation, the accountant finds that half of the purchases are being used on renegotiable work and are written off currently but that the other half are being stocked for future use, either on commercial or defense work not presently on order. Here is a situation in which half of the related sales can be eliminated from renegotiable business under the stock exemption provision. Yet, without a little extra investigation, they might easily have been left in.

Another example will emphasize the need for caution and good judgment. A manufacturer of brakes delivers a certain type to a manufacturer of trucks who is heavily engaged in filling military orders. Not being satisfied with a "fully renegotiable" reply to his inquiry, the brake manufacturer makes additional inquiries, going to the truck plant to look around if necessary. Then it is revealed that one-quarter of the type of brakes delivered during the year went to fill military orders and three-quarters went into commercial channels. What a pity if the "fully renegotiable" answer had been allowed to stand!

There is one more type of exemption known as the partial mandatory exemption. This relates to sales of new durable productive equipment to customers other than the Government, provided the equipment has not been acquired for the account of the Government. Section 106c of Renegotiation Act of 1951

states that the term "durable productive equipment" means machinery, tools, or other equipment which does not become a part of an end product acquired by an agency of the Government under a contract with a Department, or an article incorporated in such a product, and which has an average useful life of more than five years. It is important to consider only that portion of sales of new productive equipment renegotiable which is equal to the ratio which five bears to the average useful life of the equipment. Reference to Bulletin F of the Bureau of Internal Revenue should be made for the purpose of determining useful life. There is no difficulty in applying the segregation factor in this case, if the following determinations have been made:

1. The sale is to a defense contractor.
2. The equipment is required for performance of a prime contract or subcontract subject to the act.
3. The equipment has an average useful life of more than five years.

There has been some difficulty in some quarters in attempting to understand just what was intended by the Congress. Attention is called to the fact that renegotiation of sales of new durable productive equipment was postponed until January 31, 1953 and did not go into effect until then. Also to be noted is that there has been considerable agitation to have a different interpretation made of the law—one which removes the clause "unless purchased for the account of the Government" and one which takes into consideration the percentage of usefulness of the machines on renegotiable business.

The writer knows of the case of one large machine tool builder who sells to practically all the large defense contractors, with annual sales running to millions. The accepted life expectancy of his machines averages twenty-five years. Yet, less than three per cent of all the sales of this company qualify for exemption under the "new durable equipment" provision, because even big name purchasers are buying the machinery for immediate or ultimate account of the government. It is the writer's opinion that this provision in the law is of doubtful benefit to the very companies it was designed to help. What happens to this provision in the law as time goes on and more experience is gained should interest all of us.

Costs of Renegotiable Business

What costs to attribute to defense business is a companion and not less difficult problem. The factors to be considered in the allocation of costs are many. The principal factor one must keep in mind, when allocating costs for purposes of renegotiation, is that the costs must first pass the test of deductibility under the Internal Revenue Code. Once that test has been met, the question then

arises as to whether all of the costs should be allocated between defense and nondefense business by one method only. It is well to remember, when preparing the required statement of income, that different classifications of cost may be allocated on different bases. Cost of goods sold (line 20—RB Form 1B, December 1951) may be allocated on a sales ratio or prime cost, or labor basis. Selling and advertising expenses (line 22 of the same form), and general and administrative expenses (line 23), may be apportioned on another basis, which must be equitable, or assigned directly when justified by circumstances.

Here is an area in which the accountant can benefit his company or client, as the case may be, by carefully taking advantage of every legitimate opportunity to charge against renegotiable business all costs which can be related directly or indirectly to the production of defense goods. There is nothing unethical about this procedure, since the Renegotiation Act expressly provides for it. On the whole, what the accountant should endeavor to do is to prevent segments of the company's profits from being unnecessarily exposed to renegotiation and to the risk of being designated "excessive." Every honest effort should be made to establish minimum permissible amounts in the category of renegotiable sales and maximum permissible amounts in the category of renegotiable costs.

Profit Allowable on Renegotiable Business

Considering how much profit is being allowed based upon the cases already settled, it appears that the present Renegotiation Board is not afflicted with "10%-itus," which seems to have gripped World War II renegotiators. Then the usual practice was that, no matter what the business, it was necessary to talk fast and be lucky to get by a ten per cent profit limitation figure. Although some companies were allowed more than ten per cent, most contractors were not. Settlements are not quite so restrictive under the current Renegotiation Act, twelve to fifteen per cent or better being fairly common. One contributing factor present today is that the personnel of the board now consists of civilians having no connection, as to functions, with Army, Navy, or Air Force procurement. Another reason for the prevailing attitude is that we are not involved in an all-out war.

It should not be concluded from these observations that a company will be allowed to retain high profits if a strong case is not presented. The board is trying to settle each case on its own merits and intends to eliminate only truly excessive profits. This is an arduous job and one which few would care to undertake. Decisions have to be made by the Renegotiation Board which must not hurt either the Government or the defense contractor who is producing

needed equipment. This cannot always be accomplished without error or possible injustice, as to excessive profits determinations. Help must be furnished to the defense contractor in presenting his case in a thorough and documented manner. The whole pattern of the contractor's presentation should be determined and executed by the company's management. The aid of someone familiar with the technical procedures is a necessity and all pertinent information must be drawn on.

The board needs to know company efficiencies, pricing policies, improved methods, cost reduction, difficulties in overcoming bottlenecks, etc. Field renegotiators are understaffed and far too busy to build a case for the contractor. If their job is confined only to the review of facts submitted and to making such verifications as they deem necessary, everyone gains and cases are disposed of more quickly.

Importance of Effective Presentation of the "Statutory Factors"

The Renegotiation Act of 1951 includes six so-called "statutory factors" on the basis of which a contractor may and should attempt to build his case for the absence of excessive profits. The wording of the law is as follows:

"In determining excessive profits favorable recognition must be given to the efficiency of the contractor or subcontractor, with particular regard to attainment of quantity and quality production, reduction of costs, and economy in the use of materials, facilities, and manpower; and in addition, there shall be taken into consideration the following factors:

1. Reasonableness of costs and profits, with particular regard to volume of production, normal earnings, and comparison of war and peacetime products.
2. The net worth, with particular regard to the amount and source of public and private capital employed.
3. Extent of risk assumed, including the risk incident to reasonable pricing policies.
4. Nature and extent of contribution to the defense effort, including inventive and developmental contributions and cooperation with the Government and other contractors in supplying technical assistance.
5. Character of business, including source and nature of materials, complexity of manufacturing technique, character and extent of subcontracting, and rate of turn-over.
6. Such other factors the consideration of which the public interest and fair and equitable dealing may require, which factors shall be published in the regulations of the Board from time to time as adopted."

There is evidence that Congress was serious in intending that defense contractors should avail themselves of the statutory factors when presenting their case for consideration by the Renegotiation Board. Furthermore, Congress has made it clear that the Renegotiation Board *must* give heavy weight to any representation which carries with it evidence of compliance with the intent of the statutory factors. So the door is open for those engaged in defense production

to really do a thorough job of presenting the whole story in a manner which is convincing though not necessarily lengthy.

In this connection, it is no longer necessary for a contractor to guess what is wanted by the Renegotiation Board. Form RB-2 which is filed only when it is requested (and then only as to the parts on which the Board requires data) is an excellent chart of the course to be followed when organizing and presenting the company's case. It is suggested that a careful study of the questions set forth under each section of the form, regardless of whether the company has been requested to answer them or not, is in order. In that way, it will be seen if there is anything in the company's operations around which a renegotiation story can be built.

Section B of the form, relating to "Business of the Contractor," is especially pertinent. Following a general statement of the character of normal commercial business and of business which is in the renegotiable category, a chance is really offered to present some effective facts. Here are a few questions which are involved:

1. What is there about this business which is different from that of those who might be considered competitors?
2. What significant differences are there between the normal and renegotiable business?
3. Do we have any complex manufacturing techniques?
4. Do we work to unusually close tolerances?
5. Have we perfected any methods for keeping rejects low and performance high?
6. Have we put into effect any improved or mass production methods which have helped to reduce costs or to step up output, or both?
7. Can we illustrate any of the foregoing points with evidence in the way of blueprints, pictures, letters from other companies or from procurement officers?
8. Can we prepare and furnish a summary of improved methods which have been put into effect and which show results both before and after, in terms of productive hours saved?

These are just a few of the questions which should be rolling through the accountant's mind as he considers Section B of RB-2 form. In all, there are fifteen sections and nearly each one of them gives equal opportunity to present persuasive data.

Substantiating Salaries Claimed Against Renegotiable Business

Another important part of Form RB-2 is Section E, Salaries and other Compensation. For many companies this section is the heart of their whole renegotiation case. I make this statement because many small businesses engaged in defense work operate as individual proprietorships, partnerships, or closely held corporations. In each instance, the Renegotiation Board must make a salary allowance for a working owner, regardless of whether funds are withdrawn or

not. It is necessary, particularly where no adequate salaries have been withdrawn, to provide plenty of ammunition for the Board to arrive at a figure which the owners will consider satisfactory.

In Section E of Form RB-2, the contractor is invited to furnish a statement as to the amount he believes is a reasonable compensation for the services of active partners or the proprietor. He might be considered remiss in his duties if he did not take advantage of this section to justify proposed salary allowances, so as to make the owners appear to be worth "every nickel" of the proposed salary. He does not have to exaggerate to accomplish this objective. For example, under duties, time devoted to business, etc., he can really prove his point if he knows there is truth and justice to support his contention.

Suppose the object is to show that a $25,000 salary allowance is appropriate, notwithstanding that the particular officer was content with $15,000 in drawings prior to the defense program. The following considerations might be stressed:

1. That the officer is now working unlimited hours, frequently between sixty and eighty hours per week, or more.
2. That the nature of the work is such that terrific strain is placed on the man. For example, if he is doing considerable estimating and bidding on work, where he does not get a chance to second guess or retrieve a miscalculated bid, the strain is obvious. Particularly is this true when it is his own capital and that of his partners, which is supporting the performance of the work, at the quoted price. The tremendous amount of work involved may be indicated by preparing a schedule or statement showing the volume of work bid on and whether it was on fixed-price contracts or not. This statement should show the percentage of successful bids to total figured.
3. Many small defense contracts have one man performing jobs which are normally spread around among several men in larger companies. This is so, even though there may be no large disparity between the small and larger company in the amount of defense sales volume handled. Thus we have engineers, quality control men, estimators, production supervisors, expediters, customer-contact men, and other separate jobs, sometimes being performed by one or two bosses in the small companies. Were a fair salary assigned to each of these functions, the total would usually run far in excess of the amount which the executive-proprietor is claiming for himself, even on a stepped-up basis. This is important data to expand on when presenting information under "salaries and other compensation."

Renegotiation Involves Giving as Well as Taking

Some of the rules of good poker or horse-training are pertinent to renegotiation. For all the niceties of the renegotiation process called for by law and administrative practice, the whole procedure resolves itself into a give and take operation, much the same as does a revenue agent's examination of a tax return. In renegotiation, however, there is less certainty. There are no flat tax rates, no reduction of the whole thing to a net taxable income figure. The element of human judgment and comprehension and versatility of both parties—company representative and the renegotiator—play such an important part in the final determination of clearance or excessive profits that no rebuttal point should be overlooked.

If the renegotiator says, "Your case looks good under the statutory performance factors, but let's face it—you have had higher sales by reason of defense business and more net income," be ready with an argument when he suggests that the Government is entitled to a cut on these grounds alone. When he later concedes that perhaps your percentage of return on sales is not too unreasonable both in the light of your past record and by comparison with others in the same industry but that a 120 per cent return on invested capital is too high, be ready to show why, in your business, invested capital is a poor yardstick for the purpose of measuring whether excessive profits exist or not.

In this article I have endeavored to point out that doing business under the Renegotiation Act involves careful preparation and compromise. Further, that the elements of human judgment and variations in circumstance play an important part in the determination of excessive profits. To achieve the objective, a fair determination, facts supported with proof are a prerequisite. In this process the accountant can make a valuable contribution, not only to his company or client, but also to the speed and fairness with which renegotiation itself is administered.

Expediting Contract Termination Claims

by JOHN F. GAITHER

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This paper describes organization for termination in line with the departments involved. It then outlines a plan for the expeditious handling of termination claims by detailing the functions of each of these divisions. Emphasis is placed on the vital importance of careful planning so that immediate action may be taken on receipt of a termination notice.

MANAGEMENT'S PRIME RESPONSIBILITY after having a contract terminated for the convenience of the government is to expeditiously prepare a settlement proposal and submit it to the government. All too often the contractor finds himself in a state of utter confusion when termination day arrives. A sound, workable operational plan should be prepared well in advance and held in readiness for action immediately upon receipt of the notice.

Information about details of a workable plan may possibly be obtained from a higher tier contractor, or study of other contractors' plans. It is always available from government termination officers. The plan which is outlined in this article is a composite. It was established in advance of a termination notice, was activated and tested on small terminations, and is functioning smoothly at the present time. Obviously, modifications will have to be made but they will be minor.

Termination Administration

Rather exhaustive research has resulted in the conclusion that a committee structure is the most practical form of organization for administering the preparation of a proposal settlement. The termination committee is charged with the responsibility of coordinating all departmental activities required to cancel vendor subcontracts and purchase orders immediately upon receipt of notice of termination from the United States Government or a higher tier contractor. The committee operates under rules and regulations set forth in the Armed Services Procurement Regulations, Section VIII, and other supplementary instructions issued by the Armed Services. The committee consists of one representative from each of the following divisions:

1. Financial accounting division.
2. Purchasing, material control and production control division.
3. Production engineering division.
4. Inspection divison.
5. Producton division.
6. Contract administration division.

WIRE REGISTER OF TERMINATION WIRES SENT TO SUBCONTRACTORS			
Date of Wire	(Company) Wire Number	(Company) Termination Case No.	Vendor's Name

EXHIBIT 1

Each representative on the committee is responsible for the performance of the termination responsibilities of his particular division and for coordination with other divisions. The representative of either the financial or the contract administration division is a suitable chairman, in order to integrate the final claim more effectively.

Following the establishment of the operating committee, representatives of the armed services should be called in to review the complex situations which might be encountered and to assist in getting up the operational plan. Immediately thereafter, the responsibilities of the various divisions should be defined and instructions promulgated. Since notice of termination required immediate action on the part of all divisions, the value of this step is obvious. The procedure can best be followed through a step-by-step outline of each division's responsibilities.

Contract Administration Division Is the Starting Point

The contract administration division first receives the notice of termination by telegram from the Government or from a higher tier contractor. It immediately determines that the termination telegram was dated and time stamped, registers the termination wire in a termination register (Exhibit 1), after assigning a case number for internal control, forwards the original and one copy to the financial division, and notifies all operating and service divisions by phone to stop all work on the contract as directed. This notification is confirmed by inter-office letter within twenty-four hours.

This division also prepares extra copies of all correspondence and minutes of meetings which were held in connection with the termination and forwards one copy with the original to the financial division. In addition, the copies of the defense contracts and purchase orders are held available for auditing, preparation of the termination claim, and negotiation of the settlement with the Government.

Actions of the Accounting Division

Upon receipt of the termination wire from the contract administration divi-

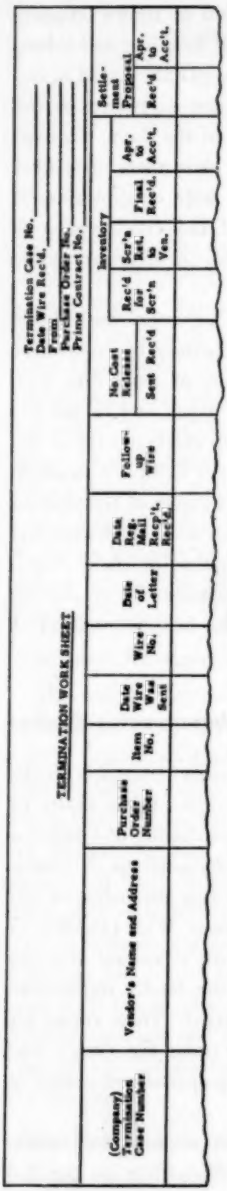
sion, the accounting division sets up the required accounts to record termination costs and issues work orders to accumulate the costs of handling and inventorying termination inventory. Two copies of the work orders are placed in the case file. The costs are recorded in one inventory account supported by the work orders, to keep costs segregated. After preparation of the claim, the total costs for it are transferred to accounts receivable and remain there until final settlement is made. Any loss which may result through audit disallowances is transferred to an appropriate expense account. Allowed and disallowed costs are set forth in ASPR VIII and these instructions furnish the necessary guide for cost accumulation.

As a next step, the accounting division sends copies of inventory work sheets to the purchasing and material control divisions for inventory of component parts, to the production engineering division for inventory of tools, dies, jigs, and fixtures, to the inspection division for inventory of gages, and to production for inventory of factory supplies. The work sheet is an enlarged copy of the appropriate "DD" form as shown in ASPR VIII and as per Exhibit 2 attached. In addition, the accounting division sends instructions and copies of termination claim forms to all divisions having contact with outside vendors, for transmittal to those vendors and subcontractors to facilitate preparation of their claims. The accounting division is further charged with the responsibility of making field or office audits of subcontractor's claims and for the final preparation of the company's claim.

Purchasing and Material Control Division — Subcontractor Claims

The purchasing and material control division is primarily charged with the responsibility of contact with the vendor and subcontractor. Upon notice of termination by the contract administration division, the purchasing and material control representative reviews materials and part requirements to determine the items open on purchase orders which will be affected by the notice of termination. He then prepares the Vendor Termination Notice Wire (Exhibit 3) which must be transmitted by the close of the first full day's business after the receipt of a termination notice and records the wire in the vendor termination register numerically. Four copies of the notice are prepared. These copies are distributed to the accounting division (two), purchase order file (one), and to the communication office (one). A change notice is prepared and mailed to the vendor, confirming the wire.

The vendor subsequently replies and indicates either a "not cost" settlement or intention to file a settlement proposal. These alternatives are handled



TERMINATION WORK SHEET

Termination Case No. _____
Date Wire Rec'd. _____
Prepared by _____
Purchase Order No. _____
Prime Contract No. _____

(Company) Termination Case Number	Vendor's Name and Address	Purchase Order Number	Item No.	Date Wire Was Sent	Wire No.	Date of Letter	Date Reg. Mail Receipt Rec'd.	Follow-up Wire	No Cost Release		Inventory					Settlement Proposal		
									Sent	Rec'd	Rec'd for Scr'n	Scr'n Rel. to Ven.	Final Rec'd.	Agr. to Acc't.	Agr. Acc't.	Rec'd	Agr. Acc't.	

EXHIBIT 2

in the following fashion. If a no cost settlement is proposed and, hence the vendor's wire indicates that there will be no termination charges involved, three copies of a no cost release are forwarded to the vendor with a letter of transmittal. When completed "no cost" release forms are received from a vendor, they are recorded on the termination work sheet. The "no cost" release form, original plus one copy, is then transmitted to the accounting division.

When the vendor's wire indicates that there will be termination charges involved, the letter of termination transmittal and the forms as covered by it are forwarded to the vendor. This letter should be sent by registered mail, with a return receipt requested. The registered mail receipt should be sent to the accounting division. Assistance should be offered to the vendor, where necessary, to compile termination settlement proposal in accordance with Section VIII of the ASPR and supplementary instructions issued by the armed services. When the vendor's inventory is received it should be reviewed to determine that:

1. The termination inventories are allocable and within the quantitative limits of the terminated purchase orders.
2. The vendor has used adequate commercial descriptions of the inventory items having commercial value, which will facilitate the screening and disposition of the inventory.
3. Each inventory schedule or set of schedules is certified by the vendor.
4. Termination inventories do not include any items which can be reasonably diverted to other work of the vendor, without loss to him.
5. Any items of inventory which the company can use in other work are noted. If any part of a subcontractor's inventory is desired at the value declared in the inventory schedules, it may be purchased by the issuance of a purchase order to the vendor. The accounting division should be notified of the purchase orders issued to procure termination inventories at the time the vendor's inventory schedules are forwarded to it.
6. Items of inventory are properly classified and listed in the appropriate inventory schedule.
7. Contract and part numbers agree with those noted in the cancelled purchase order.
8. The percentage of completion claimed by the vendor is verified by an office review or by a field audit.

If a vendor's inventory has been reviewed and found acceptable without necessity for audit, it is transmitted to the accounting division, with a letter so stating. If the review of the vendor's inventory shows that a field audit is required, the inventory is transmitted to the accounting division with the recommendation that a field audit be conducted. The higher tier contractors or the contracting officer issues instructions pertaining to the disposition of the inventories.

When the vendor's settlement proposal is received it is reviewed to determine that the form has been prepared correctly and that vendor's settlements with subcontractors are as claimed and properly supported by settlement proposals and inventory schedules. In addition, disposal credits for the inventory on hand are reviewed to see whether or not they are fair and reasonable. Such prices offered may be checked with the company's salvage sales supervisor. After the vendor's settlement proposal has been reviewed, and found acceptable, it is transmitted to the accounting division and audited by methods and to the extent deemed necessary.

Upon receipt of notification from the accounting division that a vendor's settlement proposal has been approved for payment by either a higher tier contractor or by the government, the subcontractor is requested by letter to sign and return a final release and is also requested to sign and return the final purchase order change to the purchase order being terminated. This change notice specifies the amount of the final settlement made with the vendor. In the event that the subcontractor made a scrap offer for scrap materials in his settlement proposal, it is necessary that he execute a Scrap Warranty form.

Upon receipt of the subcontractor's final release form, the signed acknowledgement copy of the purchase order change notice and/or the signed Scrap Warranty form, a transmittal letter is sent to the accounting division covering receipt of these documents and advising that payment is to be made to the subcontractor for the amount as authorized by either the higher tier contractor or the government. The company's physical inventories of raw material and purchased parts are prepared on work sheets furnished by the accounting division. Prior to the transmission of these inventories to the accounting division, they must be checked against the book inventories and any discrepancies between the book inventory and the physical inventory resolved before the inventories are transmitted to the accounting division for costing and extensions. The company's disposal offer for inventories or a statement that we do not desire to make an offer for the inventory are prepared and transmitted to the accounting division. An area is established for the storage of all termination inventories.

PURCHASE ORDER CANCELLATION
TO SUBCONTRACTOR

Evansville, Indiana

_____

_____

_____

Wire No._____ Purchase Order No._____

Item (s)_____ under Prime Contract No._____

_____ hereby completely cancelled for convenience of the government. Immediately completely cancell all committiments with your suppliers relative thereto. Do not ship any completed items now in your plant. These become termination inventory. Please acknowledge, advising by wire quantity previously shipped, quantity in transit, quantity on hand, and whether termination charges involved. In reply refer to wire No._____ Termination case_____, Attention Mr._____ Vendor claims.

(Company name)

Address

EXHIBIT 3

Parts Played by Inspection, Process Engineering, and Production

Upon receipt of the notification of a termination from the contract administration division, which is confirmed by letter, the inspection division termination supervisor makes a review to determine whether or not there are any open purchase orders for inspection division equipment which will be affected by the notice of termination. He prepares vendor Termination Notice Wire (as in Exhibit 3 for complete termination and as in Exhibit 4 for partial termination) in quadruplicate. All termination wires are sent by the close of the first full day of business after the receipt of a termination notice. He numbers termination wires numerically and records them in the termination notice wire register. He uses the same procedure for handling vendor claims as that followed by the purchasing and material control section.

It is his responsibility to prepare the company's physical inventory of inspection equipment on work sheets provided by the accounting division. The inventories should be compared to the book inventories and any discrepancies which exist must be resolved prior to the transmission of the inventory schedule to the accounting division. The termination supervisor transfers termination inventory

PURCHASE ORDER REDUCTION
TO SUBCONTRACTOR

Evansville, Indiana

_____

_____

_____

Wire No._____ Prime Contract No._____ terminated for the convenience of the government. Reduce our purchase order No._____. Item (s)_____. To read:

Do not ship any completed items beyond this reduced quantity. Immediately cancell all commitments with your suppliers in excess of amount necessary to complete this order as above advised. Please acknowledge, advising by wire quantity previously shipped, quantity in transit, quantity on hand, and whether termination charges involved. In reply refer to telegram No._____. Termination case_____. Attention Mr._____ Vendor claims.

(Company name)

Address

EXHIBIT 4

to the area established by the purchasing and material control division. If there are no termination inventories as the result of a termination, he advises the accounting division by letter to this effect.

Upon receipt of the notification of a termination from the contract administration division, which also is confirmed by letter, the process engineering termination supervisor follows the same steps as the inspection division termination supervisor, except that the purchase orders and inventories involves studs, dies, jigs, fixtures and machinery.

Upon receipt of the notification of a termination from contract administration division, again subject to confirmation by letter, the production termination supervisor prepares the company's physical inventory of work-in-process and finished production on the work sheets provided by the accounting division. These inventories should be reviewed to eliminate any common items which may be used on other work prior to the transmission of the inventory work sheets to the accounting division. The production termination supervisor like-

wise transfers termination inventories to the termination inventory area established by the purchasing and material control division. If any inventories are to be diverted to other contracts, he notifies the accounting division as to quantities, the contracts, and the releases to which the inventories are being diverted. If there are no termination inventories as the result of a termination, he notifies the accounting division by letter to this effect. He prepares and transmits to the accounting division the company's disposal offer for inventories or transmits a statement that the company does not desire to make an offer for the inventory.

The Termination Officer Will Help

We are all fortunate that the Armed Services Procurement Regulations provide specific instructions for the preparation of settlement proposals. These regulations will be followed to the letter by all the services and may be used as a very reliable guide. Experience shows that it is very desirable to request assistance from the contracting or termination officer in the area to help map a sound termination program. Since the subcontractor's contractual rights are against his higher tier contractor, the termination plan must be disseminated to all levels in order to arrive at a consistent method of preparing claims, all of which form part of the claim of each successively higher tier contractor. The preparation of claims can be muddled and confused and contractors can have funds frozen needlessly through short sightedness and failure to expect and anticipate a termination.

It is our earnest desire that the tried and proven information contained in this article may be helpful to other contractors. The science of accounting progresses and grows strong through interchange of ideas and solving of mutual problems.

Backing Overhead Claims For Cost-Type Contracts

by RAYFORD W. HARWELL

Accounting Supervisor, Consolidated Vultee Aircraft Corporation, Fort Worth, Texas.

The overhead problems entailed in the cost reimbursement type of government contract are discussed in detail in this article. Admissibility of items and their method of distribution are outlined and accounting procedures for submission of progress and final claims described. A detailed set of schedules is presented for illustration.

BECAUSE THE GOVERNMENT HAS AWARDED, during the past few years, hundreds of contracts to manufacturers, and especially because some of these companies have never previously been engaged in government contract work, the problem of allowability and proper allocation of overhead to government contracts will continue to be a major problem for both the contractor and the government auditor. It is the responsibility of the industrial accountant to alleviate these problems for the contractor.

It is the purpose of this article to set forth suggestions and recommendations that will assist in eliminating some of those which arise under cost-reimbursement type contracts, in the settlement of the "final overhead claims" presented by the contractor at the end of the fiscal year.

Much has been learned during the war and post-war years concerning admissibility and inadmissibility of costs under government cost-type contracts. The earlier conception of some costs considered inadmissible has been reversed because of decisions rendered by the Court of Claims, the Office of Contract Settlement, the Board of Contract Appeals and the Comptroller General. In order to arrive at a more uniform method of auditing contractors' costs, the Departments of the Army, Navy and Air Force coordinated their efforts and prepared a statement of cost principles, which are contained in Section XV of the Armed Services Procurement Regulations.

The Contract Audit Manual of the Department of Defense summarizes the general bases for determining cost under cost-type contracts by reference to these principles.

It provides that costs must be reasonable and be determined by the application of generally accepted accounting principles and practices. It approaches overhead, as follows:

> "The total cost of a contract is the sum of the allowable direct costs incident to the performance of the contract plus the properly applicable portion of allowable indirect costs, less applicable income and other credits."

INDIRECT COST PRACTICES --PART O OF GUIDE TO SURVEY OF INTERNAL CONTROLS AND ACCOUNTING PRACTICES

	Yes	No	W/P Ref
1. Are costs unallowable under terms of contract or Government regulations segregated on the records from costs to be apportioned to Government contracts?			
2. Where overhead items are claimed as a direct cost of the contract, are other costs of the same nature excluded from the overhead pool for allocation to Government contracts?			
3. Are adjustments resulting from physical inventories of small tools, supplies, and indirect materials entered in the cost records?			
4. Are acceptable bases established for apportionment of indirect expenses?			
5. Is a comparison made of monthly totals of each overhead account with previous monthly totals to determine unusual increases or decreases, and reasons therefor?			
6. Are year end overhead statements prepared in support of final (annual) overhead settlement claim?			
7. Are year end adjustments normally of such a nature and amounts as not to distort cost of Government contract?			
8. Are significant adjustments of prior period's transactions apportioned between Government and commercial work in the ratio existing at the time of the original transaction?			
9. Are incomes (arising from indirect costs) and other credits considered before the allocation of indirect costs?			
10. Are travel advances, per diem allowances or actual travel expenses adequately controlled?			

EXHIBIT 1

The Contract Audit Manual further defines overhead, or indirect cost, as:

"An item of cost (or the aggregate thereof) which is incurred for joint objectives, and, therefore, cannot be identified specifically with a single final objective, such as a product, service, program, function or project. An indirect cost usually is allocated to the several cost objectives. A cost may be direct with respect to some specific service or function which in itself is indirect with respect to the end-product, service, program, function, or project. In practice the distinction between direct and indirect costs is sometimes arbitrary or is based upon convenience and practicality without sacrifice of reasonable accuracy in overall costs of specific objectives."

The Question of Distributing Overhead

In auditing costs of defense contracts, the difficult problem is less the identification of overhead than its distribution. Very often a contractor does not

use the best judgment in the method of distribution usually with the effect of penalizing certain jobs to the advantage of others. Nor is the difficulty diminished by the fact that no set system can be prescribed for all plants nor even for all plants in similar industrial production. To go further, the difficulty is not infrequently aggravated by neglect of it. A contractor does not always recognize the necessity for proper distribution of expense, and will employ arbitrary percentages based on opinion only. The result is unscientific and unsatisfactory. Careful distribution of overhead will enable a contractor to bid more reasonably. Very frequently overhead is from 100 percent to 250 percent of direct labor and is therefore, that much more important than the direct labor itself. The contractor's interest in the accurate distribution of expense should far exceed the government auditor's interest.

The most common methods of distributing overhead among which selection must be made are:

Direct labor dollars, Direct labor hours, Units produced, Machine hours, Prime costs and Floor space.

Overhead may sometimes be distributed by a single rate but this practice is easy to question in most cases. The background of industrial practice in this respect is described by Louis E. Zraick writing in the *N.A.C.A. Bulletin,* June 1951.

> "Frequently, overhead in a large industrial organization is classified primarily by application. When this practice is followed, all of the indirect costs and expenses fall into three main groups: (1) specific departmental overhead, (2) general plant overhead, and (3) administrative, selling, and general overhead. One or more overhead rates may be developed in large companies and the choice and number, if more than one, will depend on the scope of the work and the magnitude of the operations. Related to defense contracts, the departmentalization of burden rates becomes quite important."

Once the correct and equitable method for allocation of overhead cost has been determined, the settlement of the overhead cost as to allowable and unallowable comes into view as an additional responsibility of the accountant.

The Question of Allowability of Overhead Categories

The Contract Cost Principles of Section XV of the ASPR name the following overhead costs as unallowable for commercial, supply and research cost-reimbursement type contracts:

Advertising products for resale
Antitrust litigation expense
Bad debt expense
Bond discount
Bonus to obtain government contract
Commissions to obtain government contract
Contingency reserves
Contributions
Dividend payments
Donations to charity

ABC Manufacturing Company

Schedule I

STATEMENT OF OVERHEAD DUE CONTRACTOR FOR FISCAL YEAR 195__
Contract AF__

	A	B	C	D
	Administrative	Engineering	Tool Planning & Design	Manufacturing
Portion of Overhead allocable to this Contract per schedule below:	$ 274,536.00	$ 111,678.00	$ 33,000.00	$ 1,478,814.00
Less: Progress Payments received per Schedule IV.*	273,700.00	106,400.00	31,400.00	1,465,500.00
Net Amount of Final Claim	$ 1,836.00	$ 5,278.00	$ 1,600.00	$ 13,314.00
Total Overhead charges for the year to be allocated per:				
Schedule II (1)	$782,700			
Schedule II (2)		$300,100		
Schedule II (3)			$81,000	
Schedule II (4) **				$4,223,500

Allocation of Overhead per Percentages on Schedule V***

Description	Total all Contracts	Fixed Price and Others	Cost Plus Fixed Fee Contract Number Total	AF-200	AF-300	AF-400	AF-500
Administrative							
Percentage	100.000%	44.509%	55.491%	35.331%	9.669%	5.384%	5.107%
Allocation	$ 782,700	$ 348,372	$ 434,328	$ 276,536	$ 75,679	$ 42,141	$ 39,972
Engineering							
Percentage	100.000%	35.004%	64.996%	37.214%	13.780%	7.369%	6.633%
Allocation	$ 300,100	$ 105,047	$ 195,053	$ 111,679	$ 41,354	$ 22,114	$ 19,906
Tool Planning and Design							
Percentage	100.000%	6.611%	93.386%	40.741%	27.116%	14.947%	10.582%
Allocation	$ 81,000	$ 5,357	$ 75,643	$ 33,000	$ 21,964	$ 12,107	$ 8,572
Manufacturing							
Percentage	100.000%	46.379%	53.621%	35.011%	8.833%	4.951%	4.823%
Allocation	$4,223,500	$1,958,817	$2,264,683	$1,478,816	$373,062	$209,105	$203,700

*See Exhibit 5 **See Exhibit 3 ***See Exhibit 6

EXHIBIT 2

- Entertainment expenses
- Excess profits taxes
- Financing costs
- Federal taxes on income
- Income taxes
- Interest on borrowings
- Legal expenses related to government litigation
- Losses on sale or exchange of capital assets
- Maintenance costs on excess facilities
- Memberships in organizations for sales, credit, or political purposes
- Organization and reorganization expense
- Reserve for bad debts
- Reserve for contingencies

ABC Manufacturing Company

Schedule II (4)

STATEMENT OF MANUFACTURING OVERHEAD EXPENSES*
Fiscal Year 195___

Account Number	Title of Account	Ledger Balance	Deletions by Contractor	Balance for Proration
4001	Supervisory Salaries	$1,140,900	$	$1,140,900
4005	Other Salaries	176,900		176,900
4006	Indirect Wages	1,526,900		1,526,900
4007	Janitors' and Sweepers' Salaries	55,000		55,000
4012	Vacations, Holidays and Sick Leave	519,600		519,600
4013	Overtime Premium - Indirect	68,200		68,200
4016	Shift Premium - Hourly Indirect	46,500		46,500
4022	Telephone and Telegraph	38,800		38,800
4025	Operating Supplies	160,300		160,300
4026	Perishable Tools	83,000		83,000
4029	Miscellaneous Departmental Expense	18,500		18,500
4038	Rearrangement - Labor	17,500		17,500
4048	Rearrangement - Supplies and Expenses	11,800		11,800
4051	Social Security Taxes	147,600		147,600
4052	Compensation Insurance	46,300		46,300
4054	Employees' Retirement Plan	20,400		20,400
4062	Power and Light	87,900		87,900
4063	Fuel	15,800		15,800
4068	Taxes	3,900		3,900
4090	Miscellaneous Expense - Unreimbursable CPFF	200	200	
4091	Miscellaneous Expense - Other	1,000		1,000
		$4,224,048	$548	$4,223,500

*Similar schedules submitted for the other classifications of overhead which the company maintains, i.e. administrative, engineering, and tool planning and design.

EXHIBIT 3

Nevertheless, an element of flexibility exists in Section XV. In Part 5 it lists items as examples only of types of costs, most of which are considered as overhead which have in the past caused some confusion due to a lack of a clear understanding. The background suggestion is that agreement on such items reached at the time the contract is negotiated if the matters are likely to prove controversial, so that misunderstandings, arguments, and appeals can be avoided and all concerned thus benefited. It is not true, however, that the contract must deal with each of the items so listed or that failure to make specific provision for such items will automatically result in disallowances.

The absence of a specific contract provision merely means that the general basis for determination of costs as set forth in Part 2 of the Contract Cost Principles will be used or the tests of allowability will be reasonableness, application of generally accepted accounting practices, and allocability will apply. The cost principles specifically state that failure to mention any item of cost is not

ABC Manufacturing Company
Schedule III
STATEMENT OF DELETIONS BY CONTRACTOR FROM OVERHEAD EXPENSE
Fiscal Year 195__

Account Number	Description	Note	Administrative 1000	Engineering 2000	Tool Planning and Design 3000	Manufacturing 4000
-12	Sick leave beyond approved policy	(1)	$	$	$ 67	$
-13	Overtime premium not approved by Contracting Officer	(1)	75			
-19	Taxi fares considered excessive by Contracting Officer	(1)	9			
-19	Auto mileage considered excessive by Contracting Officer	(1)				37
-20	Travel costs unreimbursable under CPFF Contracts	(1)	600	700	100	300
-21	Membership in local Opera Association	(1)	100			
-24	Consultant fees - Acme Associates	(3)	11,400			
-59	Premium transportation not approved by Contracting Officer	(1)				11
-60	Donations-unreimbursable under CPFF contracts in accordance with Section XV, paragraph 15-205(f) ASPR	(1)	7,000			
-72	Audit Fees & Expenses	(2)	1,700			
-90	Miscellaneous expense which is unreimbursable under CPFF contracts	(1)	5,100	300	100	200
			$25,984	$1,000	$267	$548

NOTES: (1) To be conceded as unreimbursable.
(2) To be submitted in separate public voucher in accordance with local Government Auditor's request.
(3) Deleted pending negotiations with Contracting Officer.

EXHIBIT 4

intended to imply that it is either allowable or not allowable. A contractor does have the opportunity under the "consideration" article to make sure that unusual circumstances peculiar to his business are given special treatment in the contract, and that specific principles are adapted to his situation as much as possible.

From Progress Payments to Final Claim

One of the goals envisioned by the Armed Services Procurement Regulation and the Contract Audit Manual is that the contractor be reimbursed as promptly

as possible for costs expended under a cost-type contract. In the case of overhead, this means the amount has been definitely established or is based on reasonably accurate accruals. As a general rule, overhead can be currently reimbursed on a progress payment basis, the request for which must be properly supported by a statement detailing the major elements of cost in it and showing the method of apportionment. These requests will be reviewed by the government auditor to determine that the amounts requested are sufficiently under the amount of actual overhead accumulated on the contract to date to provide a proper margin of safety. Progress payments apply against the final overhead claims which will be presented by the contractor as basis for the settlement of overhead at the close of the fiscal year.

The procedure preceding the submission of the final overhead claim is important and is tied in under the now-prescribed review of the contractor's accounting. As the initial phase of an audit assignment, the government auditor conducts a survey of the contractor's internal controls and accounting practices. From this survey can be determined the extent to which reliance can be placed on the internal controls and accounting practices and hence the amount of detailed audit to be performed. The Contract Audit Manual which contains a guide to this survey includes in it the material relating to Indirect Cost Practices as shown in Exhibit 1 to this article.

More or less concurrently with their incurrence the government auditor reviews the charges to the overhead expense accounts and advises the contractor from time to time of those items which are to be excluded from overhead applicable to the cost type contracts. Treatment of such items must be settled before the submission of the contractor's final overhead claim for the fiscal year or else the tentative exceptions, if not deleted from the claim and conceded by the contractor, will be included on a DD Form 396 "Notice of Cost Suspended and/or Disapproved," and will be subjected to the procedures of the governing regulations or of the contract in regard to disputes and appeal. The contractor should be prepared to investigate all tentative exceptions promptly. If these are not cleared with the auditor the contractor should present to the contracting officer a written request for approval of each item to be allowable under the provisions of the contract or the applicable regulations.

Much conflict of opinion and actual dispute within the meaning of the "disputes" article can be avoided if the contractor will meet with the contracting officer (or with the resident auditor in attendance) prior to the submission of the final overhead claim and resolve any unsettled exceptions by a mutually agreed upon memorandum of understanding. This prior resolution of questionable

ABC MANUFACTURING COMPANY

Schedule IV

STATEMENT OF OVERHEAD PROGRESS PAYMENTS RECEIVED FOR FISCAL YEAR 19__

Contract AF—200

Public Voucher Number	Payroll Period	Administrative	Progress Payments Received		
			Engineering	Tool Planning and Design	Manufacturing
1	1/1 - 1/31/5-	$ 19,100	$ 7,200	$ 2,200	$ 113,800
2	2/1 - 2/28/5-	18,000	6,700	2,000	113,400
3	3/1 - 3/31/5-	21,200	8,000	2,400	115,900
4	4/1 - 4/30/5-	23,100	8,800	2,600	117,100
5	5/1 - 5/31/5-	23,300	8,900	2,700	119,000
6	6/1 - 6/30/5-	24,000	9,300	2,700	119,400
7	7/1 - 7/31/5-	26,100	10,100	2,800	120,000
8	8/1 - 8/31/5-	26,500	10,000	2,600	121,000
9	9/1 - 9/30/5-	24,000	9,700	2,600	115,900
10	10/1 - 10/31/5-	24,300	9,300	2,700	114,700
11	11/1 - 11/30/5-	23,100	9,100	2,900	117,300
12	12/1 - 12/31/5-	22,000	9,300	3,200	118,000
		$274,700	$106,400	$31,400	$1,405,500

EXHIBIT 5

items will have the effect of avoiding suspensions on DD Form 396, the processing of resubmission vouchers, or the furnishing of findings of fact and subsequent notices of appeal. Such predetermination of overhead items will tend to reduce the volume of paper work for the contractor, contracting officer and the government auditor.

As to the claim preparation technique the article by the present author, "CPFF Contracts—More Profit at Less Cost" which appeared in the January 1952 issue of the *N.A.C.A. Bulletin* summarized the following points, which apply to overhead costs as well as others, as necessary for a good claim for reimbursement:

> "In summary, the accountant with the proper requisites of temperament, training, and ability should be able to submit a claim which is clear as to objective, strictly to the point, complete as to facts, logical in correlation of data and facts, sound in its conclusions, intelligible in organization, and attractively arranged and typed."

Before the final overhead claims are submitted by the contractor, it will be determined by the auditor that the contractor's records have been closed for the particular accounting period and that the general ledger, cost ledgers and other subsidiary ledgers have been formally posted. Entries made in pencil or an analysis on working papers are not considered as formal postings.

Costs applicable only to commercial or other work or of a nature not considered allowable under the terms of the contract should be segregated in separate unreimbursable accounts or charged direct to the work being performed on other than government cost-type contracts.

This type of cost should be eliminated from the final overhead claims before presentation with Standard Form 1034, Public Voucher for Purchases other than Personal. Also overhead items not resolved as to allowability should be deleted from the final claim and reserved for later negotiation and settlement.

An Example of the Form of a Final Overhead Claim

For the purpose of illustration, let us assume that the ABC Manufacturing Company has four CPFF contracts which total approximately 55% of its total business and that its overhead consists of four pools designated as administrative, engineering, tool planning and design and manufacturing. The final overhead claim for this company could be submitted at the close of the fiscal year for its CPFF contract AF-200 in the arrangement shown in the set of Exhibits numbers 2 to 6. These are as follows:

Exhibit 2—Schedule I Statement of Overhead Due Contractor for the Fiscal Year 195—Contract AF-200

Exhibit 3—Schedule II Statement of Manufacturing Overhead Expenses Fiscal Year 195—

Exhibit 4—Schedule III Statement of Deletions by Contractor from Overhead Expense, Fiscal Year 195—

Exhibit 5—Schedule IV Statement of Overhead Progress Payments Received for Fiscal Year 195—, Contract AF-200

Exhibit 6—Schedule V Statement of Basis for Allocation of Overhead Expenses, Fiscal Year 195—

Schedules II (1) II (2), and II (3), relating to the company's other overhead pools, are similar in form to Exhibit 3 and are omitted here.

The net amount of the overhead due the contractor for each classification of overhead shown on Exhibit 2 must be summarized on Standard Form 1035 Public Voucher for Purchases and Service other than Personal (continuation sheet) and then attached to Standard Form 1034 for presentation to the government auditor.

The submission of the final overhead claim in the manner as outlined in the exhibits calls for close cooperation between the contractor and the government auditor. The Government has to be much more exact in its records than may be necessary in similar commercial transactions, but contractors will get their money on overhead costs with reasonable promptness if they make an honest effort to comply with the requirements of the government auditor and the contracting officer.

Policy Area for the Industrial Accountant

As stated before, it is the purpose of this article to set forth certain suggestions and recommendations which will assist in eliminating some of the prob-

ABC Manufacturing Company

Schedule V

STATEMENT OF BASIS FOR ALLOCATION OF OVERHEAD EXPENSES
Fiscal Year 195___

Description	Total all Contracts	Fixed Price and Others	Cost Plus Fixed Fee				
				Contract Number			
			Total	AF-200	AF-300	AF-400	AF-500
Administrative:							
Hours	3,257,800	1,450,000	1,807,800	1,151,000	315,000	175,400	166,400
Percentage	100.000%	44.509%	55.491%	35.331%	9.669%	5.381%	5.107%
Engineering:							
Hours	271,400	95,000	176,400	101,000	37,400	20,000	18,000
Percentage	100.000%	35.001%	64.999%	37.214%	13.780%	7.369%	6.633%
Tool Planning and Design:							
Hours	75,600	5,000	70,600	30,800	20,500	11,300	8,000
Percentage	100.000%	6.614%	93.386%	40.741%	27.116%	14.947%	10.582%
Manufacturing:							
Hours	3,910,800	1,350,000	2,560,800	1,019,200	257,100	141,100	140,400
Percentage	100.000%	46.379%	53.621%	35.014%	8.833%	4.951%	4.823%

EXHIBIT 6

lems encountered in the settlement of overhead cost under cost-reimbursement type contracts. There are some fundamentals to be observed. The industrial accountant should submit at the earliest possible date a statement of the contractor's accounting policies and procedures for the approval of the administrative contracting officer. Once approved, the policies should be followed consistently throughout the performance of the contract, unless changes in organization or operations occurring during the life of the contract warrant or require a change in the policies. In such instances, the policies should be amended by the contractor and the contracting officer's approval obtained on the amendment. To supplement the policy as stated, there should be definite agreement regarding the reimbursability of certain items of cost, generally classified as indirect cost, such as:

1. Travel.
2. Depreciation.
3. Compensation to corporate officials, executives, partners or sole proprietor, and department heads—and including salaries, fees, bonuses, pensions, retirement, etc.
4. Trade membership dues.
5. Overtime compensation, premium compensation and straight time for direct or indirect labor to the extent provided by the contract or otherwise authorized.
6. Pension, retirement, group health and accident and life insurance plans.
7. Consulting services.
8. Vacation, holiday and severance pay, sick leave and military leave.
9. Cafeteria operations, if any.

The industrial accountant should become acquainted with the terms and conditions of the particular contracts and with current government regulations relating to performance under cost-type contracts in general. He should establish approved procedure for accumulation of overhead cost and the most equitable basis for its proration. In this connection, it is desirable to segregate in separate accounts, if practical, all items of expense not considered allowable as cost under the terms of the contract and to provide policy for a segregation of charges or credits, applicable to prior years overhead, which should be allocated to the various contracts (and other work) on the same basis used in the allocation of overhead for the year involved.

As to dealings with audit representatives, the industrial accountant should insist that government audits of overhead cost be made currently, and that the contractor be advised of the tentative exceptions. He should be prepared to investigate all exclusions, exceptions or inquiries initiated by the government auditor, contracting officer or the General Accounting Office and to defend promptly the position taken on each item which the contractor believes to be allowable under the provisions of the contract or the applicable regulations. Wherever possible, before the expense is incurred, the contracting officer's approval of unusual items of expense not enumerated in the contract or the cost principles should be requested. Much embarrassment, confusion and friction can be avoided if a written record can be obtained from the contracting officer as to allowability of costs not clearly covered by the contract or the regulations. The accountant should request the government auditor to furnish copies of any GAO informal inquiries he receives and assist the auditor in the preparation of his replies to insure that they are supported by full and adequate findings, information and documentation. This should minimize formal exceptions and subsequent reclaims.

It is imperative that the contractor's staff demonstrate the highest degree of integrity in all relationships with the government. The contractor must be willing to cooperate actively with the auditor and to build up a spirit of confidence in the contractor's records. In part, this can be done by establishing effective means of control to insure that automatic checks and balances are maintained and that sound business and accounting practices are established and supported. It will also help relationships and results to be receptive to the auditor's recommendations for improvement of the contractor's accounting practices and internal controls, and to demonstrate a willingness to take prompt and effective action relating to such recommendations if they are reasonable. In short, the contractor must be able to place reliance on internal auditing for

the maintenance of sound business and accounting practices, a positive, continuous and complete procedures development and improvement program, together with a cost reduction and control program the primary objectives of which would be:

(a) elimination of unnecessary cost (b) reduction of exceptions in the audit and processing of claims, and (c) the protection of the contractor's fee or profit under his contracts.

The Requirements

The industrial accountant can meet these problems of overhead cost with intelligent analysis and hard work. The more detailed and analytical attention devoted to this component of cost under defense cost-type contracts, when added to the operation of cost control systems, should only further strengthen the constant drive for the delivery to the government of quality products, on schedule, within budgeted cost and with a fair profit to the contractor.

Defense Department Adds to Contract Audit Manual

by HOWARD W. WRIGHT

Consultant, Office of Assistant Secretary of Defense (Comptroller), Department of Defense, Washington, D. C.

The Department of Defense has just issued additional chapters of its Contract Audit Manual. These are the significant chapters which prescribe the nature, scope, and extent of auditing to be done by military department auditors. Certain other chapters, primarily administrative in nature, were published in June 1952. While the manual is not yet complete, it is substantially so, and the department's position regarding auditing is evident. All defense contractors and subcontractors will be interested in the manual, since it constitutes instructions for the audit of their accounting and other records.

The recently published material consists of two sections of Chapter IV (Audit Procedures) and all of Chapter V (Audit Procedures—Terminated Contracts). Section 1 (Procedures Having General Applicability) of Chapter IV is probably the most important part of the manual. It establishes the fundamental considerations guiding the auditor in his determinations prior to, during, and upon completion of his audit. Introduction of new concepts and changed emphasis on older ones alter significantly the auditor's work.

New Viewpoint and New Reliances for the Contract Auditor

The new manual removes the auditor from the category of a voucher examiner and gives him professional stature—and charges him with professional responsibility. No longer is he to review all the supporting documentation underlying a cost-type contract. The auditor is to obtain sufficient evidence upon which to base a professional opinion as to the reliability of the contractor's cost vouchers (cost-type contracts) or cost statements and proposals (fixed-price contracts). So long as the auditor must develop an informed opinion, the selection of the method for gathering evidence must rest with him. However, it is expected that he will accept creditable evidence wherever it may be found, in order to expedite the audit and avoid duplication of audit effort.

Accordingly, the auditor is instructed to place major reliance upon the work of a contractor's internal audit staff, consistent with the professional attributes of the internal audit. In addition, where the volume of government contracting is large, the audit program of the contractor's internal auditors may be dovetailed with that of the military department auditor. Each staff separately performs assigned parts of the audit program and exchanges working papers. The assigned parts are rotated so that, in the course of a year or two, each staff has done all phases of the audit program.

The value of audits conducted by the contractor's independent public accountants is recognized. While such audits have different objectives from those of the military department auditor, common audit procedures are used. Certain phases of the public accountant's audit may be useful in their entirety. Illustrations might include inventory verification (both book and physical), depreciation analyses, internal control reviews, and accounting system surveys. The determination of the degree of usefulness and reliability of the work of the public accountant rests solely with the military department auditor, since the findings and recommendations must be entirely his. Because of the confidential nature of the public accountant's working papers, the contractor may have to authorize his public accountants to make the papers available to the military department auditor.

Carrying Out the "Continuing Survey" Approach

The manual places significant emphasis on the extent of detailed audit work to be done. The extent of such work is, in large measure, governed by the adequacy of the contractor's internal controls and accounting practices. Where the contractor's internal controls are good and his accounting system readily yields the cost data required by the contract, the detailed auditing work should be reduced to a minimum.

This minimum should consist more of a continuing survey of internal controls and accounting practices to determine their continued reliability than an effort to audit contract costs as such. The selection of particular accounts for verification will be governed primarily by the likelihood of error or misclassification being found in such accounts, rather than merely selecting accounts at random. Similarly, not all transactions recorded in the selected account need be examined. To quote from the manual, "The objective of selective testing is to obtain the smallest sample which will be truly representative, possessing all of the characteristics of a group of like transactions under the audit." This is by no means a new concept in the field of auditing, but the emphasis placed upon it in the new manual will result in less detailed auditing and in better audits.

No longer need auditors devote their efforts to detailed "paper audits" of contractor's reimbursement vouchers or cost proposals. Although some auditing of this nature will continue to be done where small contracts are concerned and where inadequate controls or accounting systems exist, there will be a gradual transition to the "continuing survey" approach. Under this, the survey of the contractor's internal controls and accounting practices will be made at the inception of the audit. This is followed by a continuing review of such controls and practices during the performance of the contract.

The review will not be limited to pieces of paper arising specifically from the performance of the contract. Any pertinent document may be examined. The auditor must get away from his desk and into the plant. Accounting data are no better than the original evidence from which the data are prepared. Hence, auditors must make observations at the point of initiation of the original records. Also, the system of internal control may be excellently conceived and set forth "on paper" but the contractor's employees may not adhere to it. These violations destroy the foundations upon which the auditor's opinion is built. They can be disclosed only through observation.

Another feature of the changed approach is that auditors will not necessarily audit from the data submitted by the contractor, back to his accounts. Transactions may be picked up at any stage of the recording cycle and verified backwards or forwards or both ways. By auditing in this manner, as contractor's incur costs (or shortly thereafter), the audit need not await the submission of data by the contractor. The auditor can have his audit completed by the time the contractor has his data prepared. The auditor's findings and recommendations can be prepared without further field audit work, on the basis of auditing done prior to the submission of the data. Cost reimbursement vouchers can be accorded final audit approval on the basis of an office review of the voucher.

Placing All Contracts on Same Basis for Auditing

In the past, cost-type contracts were subject to more detailed auditing than contracts of other types. The new manual discourages this differentiating between types of contracts. Costs are costs. The extent of auditing work required in a particular case is not influenced by the form of contractual instrument. The adoption of this point of view will reduce "over-auditing" of cost-type contract reimbursement vouchers.

More than half of Section 1, Chapter IV, of the manual is devoted to the presentation of detailed audit procedures to be used in the audit of contract costs. These cover direct materials, direct labor, and indirect costs. They are about what one would expect to find in any audit manual covering these costs. These audit instructions are detailed, as any set of audit instructions must be. However, there is no intent that every procedure be applied in every audit. Instructions for the use of the audit procedures state that the auditor will follow only those procedures applicable to the particular contract and then only to the extent appropriate.

Important Further Recognition of Standard Cost

Cost accountants will be interested in Part IV, Section 1, of the manual, which is devoted to standard costs. Considerable confusion as to the acceptability of standard costs was caused by an ambiguous sentence in Section XV, Armed Services Procurement Regulations: "Interim payments to the contractor may be based upon standard costs, with appropriate adjustment for variances, but final payment must be based upon actual costs." Understandably, this was interpreted by many contractors, contracting officers, and auditors as prohibiting the use of standard costs as a basis for final payment under cost-type contracts. Others recognized that the sentence was meaningless, since there is no such thing as a determinable "actual" cost. Rather, there is a determinable "historical" cost which can be developed through the application of any one of several accounting methods, including standard costs. Persons in the latter group used standards in costing contracts. Those in the former did not. Hence the confusion, which gave rise to considerable criticism of the Department of Defense.

In order that no future misunderstanding exist, the following statement appears in Part IV, Section 1, of the manual: "In such case (cost-type contracts) interim and final payments may be based upon standard costs (with appropriate adjustments for variances and unallowable costs) provided, in the opinion of the auditor, there is a reasonable approximation of historical cost.

The nature of standard costs, their varying degree of usefulness depending upon the type of contract and product, and certain audit instructions complete the Part devoted to standard costs.

Part Played by the General Accounting Office

Administrative and professional relationships with the General Accounting Office comprise Section 4 of Chapter IV. The various audit activities of GAO are described and its responsibilities set forth. A distinction is made between GAO's responsibilities under cost-type contracts and those under fixed price contracts.

Most of this section is concerned with cost-type contracts. The requirements of the new "records" clause (Part 2, Section VII, ASPR) for such contracts are set forth and discussed in some detail. Obligations of both the Government and the contractor concerning cost documentation are presented. A significant portion of this section is devoted to documentation requirements of cost-type contracts which do not contain the new "records" clause. This portion is included only for completeness while existing contracts run to completion and will be deleted after the use of the new clause becomes universal.

Audit exceptions are the subject of Part IV of this Section. Informal inquiries and notices of exception are defined and instructions to military department auditors regarding the handling of such items are included. Also included are instructions to such auditors for the processing of reclaim vouchers which may be submitted by the contractor after the Government recovers amounts from the contractor following the issuance of a notice of exception.

Terminated Contracts

Chapter V of the manual is entitled "Audit Procedures—Terminated Contracts." However, it is more than a statement of audit procedures. The initial portion of the chapter is devoted to a discussion of the various termination regulations which may be applicable, with particular emphasis on Section VIII, ASPR. (For a more complete discussion of contract termination problems see "Current Defense Contract Termination Rules Compared to World War II Procedures" by Foster Hall, *Journal of Accountancy*, April 1953.) The various bases for preparation of contractor's settlement proposals are presented and the procedure for "costing out" terminated cost-type contracts is described.

A significant portion of this chapter is devoted to auditing procedures also. Contract termination creates different problems from those existing in going contracts. These problems vary with the basis of preparation of the settlement proposal. Contractor-owned inventories included in the settlement proposal give rise to diametrically opposed problems if prepared on the total cost basis, as compared with those faced in an inventory claim.

Chapter V also contains many "cost interpretations." Since Section VIII, "Termination of Contracts," ASPR, contains little more than a mere listing of account titles classified as to allowability, it has been found necessary to provide auditors with more complete guidance. This guidance is solely for the use of the auditor in preparing advisory audit reports. The latter are considered by the contracting officer in negotiating the settlement with the contractor. Under present plans, these "cost interpretations" will be rescinded upon adoption by the Department of Defense of the proposed revision of Section XV, ASPR. This proposal treats each element of cost in more detail, making unnecessary further "implementation" or "interpretations."

May Require Time for New Emphases to Take Hold

The auditing approach required by the newly published chapters is considerably different from that formerly utilized. In some instances, the manual is already being followed. In others, it is being honored only by the dust it gathers on the bookshelf. Several years must elapse before the full benefits made possible by its issuance may be realized.

How We Account for Motorized Equipment Expense

by FREDERIC A. YOUNGS

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This case study of motorized equipment expense describes in detail the various categories used for accumulation and distribution of this type of expense. Simplification to reduce clerical cost without impairing the objectives of the system are noted.

A MARKED TREND toward increased mechanization of maintenance and construction activities has taken place in the petroleum refining industry since the last war. Higher equipment costs directly associated with processing operations, are identifiable, and no special cost distribution problems arise. However, the increased use of material handling, excavating, hoisting, and other classes of industrial equipment, as well as automotive equipment has stimulated a search for adequate but simple procedures for the accumulation and distribution of these costs and their itemization by piece of equipment, so far as needed.

It is appropriate to deal first with cost accumulation. There are three segregations of cost which are significant in our discussion: garage, pool motorized equipment, and assigned motorized equipment. We will deal first with the latter two. Our determination as to whether the costs for a piece of equipment should be accumulated under the classification of assigned or pool motorized equipment is based on who furnishes the driver or operator for the equipment. If our motorized equipment department furnishes the driver or operator, costs related to that equipment are accumulated under pool motorized equipment. This fact should be kept in mind, since it is the key factor in our procedure for distributing pool motorized equipment expense. If the motorized equipment department does not furnish the driver or operator for the equipment and it is the responsibility of the department to which the equipment is assigned to supply the operator, costs are accumulated under assigned motorized equipment.

We can clarify still further the distinction between assigned and pool expense classifications. The following are examples of the types of equipment which are classified as pool motorized equipment:

Trucks for general hauling
Dempster-Dumpster trucks
Straddle trucks
Pay loaders
Tractors
Bulldozers
Trenching machines
Graders, roadrollers and sweepers
Excavator cranes

Listed below are examples of the types of equipment normally classified as assigned motorized equipment, since using departments furnish their own drivers or operators.

Pick-up trucks for foremen	Passenger cars
Fire trucks	Mobile stores trailers
Ambulances	Turnaround coordination trailers

The types of expenses accumulated under assigned and pool motorized equipment are shown below:

	ASSIGNED	POOL
Fuel	x	x
Repair wages and materials	x	x
Depreciation, taxes and insurance	x	x
Pro rata garage expense	x	x
Total	x	x

The absence, from the above list, of the wages of operators of assigned units and pool units, will be noted. This will be explained a little later. The item shown for fuel is determined by pricing the fuel issue tickets prepared by the garage filling station and by the motorized equipment tank wagon driver who supplies fuel to equipment in outlying locations. Repair wages and materials are determined by processing the mechanical orders carried out by garage personnel, to be described under that head. These first two items of expense are accumulated for each industrial unit, monthly. Depreciation, taxes and insurance entries originate in the office and are booked only once each six months. The item shown for "pro rata garage expense" is a proration of total garage expense between assigned equipment and pool equipment, based on the proportion of total garage wages charged to each.

Garage Expenses

Naturally, the garage operation is quite central to motorized equipment expense. Garage expenses are divided into two categories:

Costs associated with garage	Undistributed service costs
Supervisory and clerical salaries	Washing, greasing, fuel dispensing, etc.
Depreciation, taxes, repairs, and other expense	Tire repairs
	Minor repair materials

These costs disclose that the garage is operated to service the equipment and make all necessary repairs. It will be noted they cover two categories of costs, the first relating to costs associated with the garage itself and the second to

service work performed on specific pieces of equipment, the costs of which are charged to the garage and ultimately prorated over all motorized equipment. (So indicated earlier in connection with assigned and pool expense.) Minor repair materials include fan belts, battery cables, valve caps, cores, and other small items which we do not feel justified in accounting for at time of issue.

Accumulation of undistributed service costs, as well as direct equipment repairs, is facilitated by use of a special series of "mechanical orders" which identify and classify work performed by the garage. These are as follows:

WORK CHARGEABLE TO GARAGE	ORDER NO.
Washing	48001
Greasing	48002
Fuel dispensing	48003
Tire repairs	48004
WORK CHARGEABLE TO EQUIPMENT	
Repair fender Auto No. *116*	48*116*
Overhaul Crane No. *227*	48*227*
Repair transmission Truck No. *317*	48*317*

Not all mechanical orders relate to the subject of this paper. It is apparent from the above list that we have assigned the "48,000" series of mechanical orders to cover work performed by our garage personnel. The first several numbers have been established to cover routine garage services. For repair work, we identify the specific unit repaired by showing the equipment number of the unit as the right-hand three digits of the mechanical order. For example, if we were repairing the fender of automobile No. 116, the labor and material used on the job would be charged to mechanical order No. 48*116*; and the overhauling of crane No. 227 would be charged to M. O. 48*227*.

When garage personnel have charged time and material used to these mechanical orders, as shown by time distribution sheet and material issue tickets, this source data goes to our tabulating department, where cards are key-punched to reflect labor and material charged to each mechanical order. After the labor hours and materials have been priced, the tabulating department matches the mechanical order cards with a deck of master cards and gang punches the complete account code distribution in the cards.

Segregation of Assigned and Pool Costs by Unit of Equipment

So far, we have indicated segregation of costs only between assigned equipment and pool equipment. Costs for each of these segregations are also maintained for each unit of equipment by use of an equipment identification number.

This segregation of costs by each piece of equipment is essential for the assigned equipment since, at the end of a six-month period, the costs of assigned equipment are summarized by equipment numbers so that they may be distributed to the departments or operations to which the equipment is assigned. If the assignment of a piece of equipment is changed during an accounting period, its costs for the period are distributed based on the number of months in each assignment.

Segregation of costs by individual items of pool equipment is not essential in our cost accounting procedures but is maintained for cost analysis and control purposes. From a cost control viewpoint, motorized equipment department management is particularly interested in the segregation of repair costs for each piece of equipment, since this is the most significant item of controllable expense. Although the cost ledgers prepared for the motorized equipment department show dollar cost of repairs for each piece of equipment, the garage also maintains repair history cards on each piece of equipment on which is entered the nature of each major repair job. These cards are useful for explanations of why repair costs are high on particular pieces of equipment.

The reason that segregation of pool motorized equipment expense by individual pieces of equipment is not essential to our cost accounting system is that no recognition is given to type of equipment involved when we distribute pool equipment costs. Pool equipment had previously been classified into several categories, which resulted in some very arbitrary classification decisions for new units. Effective with 1951, we adopted our present practice of making no distinction as to type of equipment. We recognize that this procedure produces some inequities, but we do not feel that the inequities are significant enough to warrant a more elaborate system.

As previously mentioned, operators' wages are not charged to the equipment they operate. With respect to assigned equipment, the using department furnishes its own operator, and the salary or wages of the operator are absorbed by the department rather than charged to the equipment. With respect to wages paid to operators of pool equipment, such wages are charged to the operation or job involved. The following comments will clarify the meaning of "operation" or "job" in this case.

Operations to Which Pool Motorized Services Are Charged

A careful review of services rendered by our motorized equipment department indicated that they fell into two broad categories—hauling services and work services. There is some overlapping of services between these two categories

and possibly there is a better title than "work" for the second category, but these distinctions should serve the purposes of this review. In the arrangement which appears below, it will be noted that each of these two service categories has been divided into two subgroups. Opposite each, there is given the appropriate cost category for the operator wages for performing the particular service.

CLASSIFICATION OF POOL MOTORIZED EQUIPMENT SERVICES

Service	Distribution
Hauling Services	
Material to/from storehouses	Storehouse expense
Men/material between job sites and shops	Mechanical shops & trade expense
Work Services	
General plant	General plant expense
Specific jobs	Specific mechanical order appropriation

Under the first category of hauling are services for the benefit of the storehouse, such as unloading material received for storehouse stock or for direct job use, hauling material from central receiving station to storehouse, transferring material between storehouses, hauling material from storehouse to work sites and returning unused material to stock, and rearranging and relocating material within storehouses. As indicated, wages of operators performing this service are chargeable to storehouse expense. Under the second category of hauling are services for the benefit of the maintenance and construction department, such as transporting personnel to and from plant entrances and work sites and between work sites, hauling tools between tool rooms and work sites, and hauling materials between work sites and shops. Wages of operators performing this service are chargeable to mechanical shops and trades expense.

As to the work services, the first is general plant work services and includes such items as road maintenance, general plant cleanup, rubbish disposal, and street sweeping. Wages of operators performing this service are charged to general plant expense.

The second or specific jobs category of work service covers all work performed by motorized equipment department not included in the three previous categories. Specific examples are such activities as grading for construction, new roads, etc., trenching for pipe lines, hoisting material or equipment into and out of process units, hauling spent catalyst to dump areas, etc. Wages of operators performing this work are chargeable to the mechanical order or appropriation for which the service is being rendered.

Basis on Which Pool Motorized Equipment Expense Is Distributed

Before 1951, wages of operators of pool motorized equipment were recorded charged to the equipment being operated. Separate equipment time reports were prepared indicating the job or operation on which the equipment was being utilized. The requirement placed a considerable clerical burden on the motorized equipment department and the accounting division. When we were considering ways in which we could simplify the procedure for ascertaining the job or operation on which equipment was used, it immediately became obvious that the answer lay in changing our method of recording the operator's wages, since there was no real reason why the operator's time had to be charged as such to the equipment he was operating. By merely charging his time to the operation or job on which the equipment was being utilized, we could provide a basis for a subsequent distribution of pool motorized equipment expense. This change eliminated the necessity for separate time reports on the equipment and made a substantial reduction in clerical effort.

In addition to these economies resulting from elimination of operator equipment time reports, further economies were obtained from changes made to correct what we feel was a fallacy in our thinking underlying equipment charges to jobs. As was noted earlier, when equipment is utilized in the two categories of hauling services, the operator's wages are considered either storehouse expense or mechanical shops and trades expense, both of which are overhead accounts. Under the system we previously used, in which there were equipment time reports indicating the job or appropriation for which men or materials were being transported, jobs or appropriations either benefited or were penalized because of their geographical location.

The storehouse delivery truck might have made a trip to deliver two identical valves, one to a process unit only a block away from the storehouse and the other to a unit in a very remote location in the refinery. Both units would pay the same material cost for the valves, but the first unit would be charged with practically no delivery cost while the other would be charged a substantial amount. It is felt that each of the two units should pay the same amount for the delivered cost of the valves by application of a storehouse overhead rate, inclusive of delivery expense, to the material cost of the valves. Also, as a practical matter, the dispatcher's log indicated that the average delivery truck was making many deliveries during a day, and the operator was turning in time against only three or four jobs—the ones requiring the longer hauls.

Since we use average departmental rates in distributing our wage payroll, we must arrive at separate distributions of hours worked for each department.

Monthly, we prepare a duplicate set of distribution cards for our motorized equipment department and, at the end of a six-month period, prepare a tabulated report showing distribution of motorized equipment wages for the period. This six-month report then supplies the basis for distribution of our pool motorized equipment expense, as shown below.

DISTRIBUTION OF POOL MOTORIZED EQUIPMENT EXPENSE
(Hypothetical Amounts Used for Illustrative Purposes)

TYPE OF EXPENSE	DISTRIBUTION OF OPERATOR'S WAGES		ALLOCATION OF POOL INDUSTRIAL UNITS EXPENSE
	Amount	%	Amount
Storehouse expense	M$ 10	20%	M$ 24
General plant expense	5	10	12
Mechanical shops and trades	10	20	24
Various specific jobs (Detailed by accounts)	25	50	60
Total	M$ 50	100	M$ 120

This table shows how $50,000 in wages paid to motorized equipment department personnel for a particular period was distributed, and how, in the same proportions, $120,000 total cost for pool motorized equipment was distributed to storehouse expense, general plant expense, mechanical shops and trades expense, and various other accounts.

Present System of Accounting Economical and Revealing

Our experience since adopting this cost distribution system for motorized equipment expense has been very satisfactory. Clerical costs of expense accumulation have been reduced and more satisfactory distribution basis for such expense achieved. It is felt that our resulting cost distributions present a more realistic picture of operations than our previous ones.

Development of Standard Costs for Heat Treating

by W. P. CANFIELD

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This paper outlines the detailed techniques used in arriving at a basis for the installation of standard costs for heat treating of metal parts, starting with temporary historical standards pending the installation of engineered standards. Establishment of the unit for costing and the setting of the engineered standards are described in detail. Specific cost reduction results obtained are noted.

OUR HEAT TREATING DEPARTMENT is operated by one of the two associated companies of which our organization consists and services both. It possesses parts for ball bearings made of different types of steel. The equipment involved includes electric, barburizing and tempering furnaces, slow cool chambers, a washing machine and sand blast machines.

The setting of standards on engineering data for heat treating operations at the time of installation of our standard cost systems, appeared in prospect to be a time-consuming task. Therefore, in order not to delay the completion, we set our standards for heat treating operations on available historical data and then revised these standards on engineering data after the systems were in operation.

A brief description of operations will be a useful prologue to this paper. The electric furnaces are continuous-type belt furnaces. The parts are fed in the front or charge end of the furnace, pass through the furnace on the belt, and then into a quench tank on the discharge end of the furnace, from which they are removed by conveyor. The operation they perform is called hardening.

The carburizing furnaces are electrically heated gas carburizing furnaces of the batch type. The parts are packed in pots of various sizes, each batch or load being made up of three to five pots. Gas, the carburizing agent, permeates the atmosphere in the furnace. The batch is heated to the carburizing temperature, held at this temperature for a specified carburizing period, cooled in the furnace under protective atmosphere, and removed from the furnace below the critical scaling temperature. The operation thus performed is carburizing which imparts a wear resisting surface and produces a part which, after hardening, will have greater toughness and more shock resistance than a part which is through

hardened. The carburizing furnaces may also be used for the hardening operation.

The tempering furnaces are electrically heated furnaces of the batch type. they are similar in appearance to the carburizing furnaces, although no gas is introduced and the batch is processed at a temperature far below the critical temperature. The operation performed is tempering (or drawing), which is reheating, after hardening, to some temperature below the critical range, followed by cooling. The purpose of tempering is removal of strains, the reduction of brittleness, and control of hardness.

The slow cool chambers are used for storage of a batch immediately after carburization while the parts are cooling, to prevent scaling. The washing and sandblasting machines are for the washing and sandblasting of parts after the foregoing operations.

The "Rise" of Pounds Processed Costing Basis As Expedient

The setting of engineering standards for heat treat operations involved the determination of standards, as to the electric furnaces, for belt speeds, pieces per square foot of belt area, pounds per square foot of belt area, method of loading on belt, pieces per furnace-hour and man-hours per furnace-hour. For the carburizing and tempering furnace, standards were needed for type of parts, method of packing, pieces per pot, pieces per batch, time allowance for various types of parts for heating up, cooling off, and carburizing cycles, pieces per furnace-hour and man-hours per furnace-hour. It looked as though engineered standards might be some time away.

That is why we turned to historical data for the time being. The historical data, available without study, consisted of pounds processed, direct labor hours, direct labor cost, and overhead cost for the department. We proceeded to set up our standard costs for heat treating on this data, using pounds processed as a basis for application of costs. We were of the opinion that the use of pounds processed as a basis for the application of heat treat costs would not prove entirely equitable, but we decided to use this basis temporarily for these reasons:

1. Pounds processed was the basis used in the job cost system being replaced.
2. Historical data on pounds processed was available for setting the standards and could easily be obtained for current production for purposes of application of costs.
3. Inquiry was made at several metal fabricating plants and this disclosed that pounds processed were used as the basis for heat treat costs.
4. The use of some base other than pounds processed would require time for study and this time was not available.

The operations which have already been briefly described, were grouped as follows into processes for the application of the standards developed.

1. *Hardening in Electric Furnace*—Hardening of parts in the electric furnace, washing in washing machine, tempering in tempering furnace, sampling for approval by laboratory and weighing.
2. *Carburizing*—Packing of parts in pots, carburizing in carburizing furnace, cooling in cooling chambers, weighing, then later sand blasting.
3. *Carburizing and Hardening*—Packing of parts in pots, carburizing and hardening in carburizing furnace, quenching, washing, tempering, sampling and weighing.

The "Fall" of Pounds Processed Costing Basis After Studies

Once our standard cost systems were in operation, with the heat treat costs based on historical standards, we proceeded to refine and we undertook the studies necessary for establishing heat treat standards on engineering data. Preliminary studies confirmed our suspicion that the standards based on pounds processed were not equitable. This is demonstrated by a series of four studies. The first study related to parts of varying weights. On our electric furnaces, we processed two parts of the same steel and the same external dimensions but of different wall thicknesses—one part had a light wall and a light weight per piece and the other part had a heavy wall and a relatively heavy weight per piece. The maximum number of pieces of the lighter part which could be accommodated on a square foot of belt area was 460. These weighed 9.2 pounds. In the case of the heavier part, 457 pieces could be accommodated on one square foot of belt area and these weighed 22 pounds, the maximum weight per square foot which may be loaded on the belt. The following table which includes the foregoing figures, develops the relationship of pounds processed per hour on the same equipment for these two types of parts:

Relative Production In Pounds Per Hour on Electric Furnaces For Parts of Various Weights

Part No.	Std Pcs/Sqft	Lbs/SqFt	Std Belt Speed	Std SqFt/Hr	Std Lbs/Hr	Relative Lbs/Hr
11530-80	460	9.2	45 min.	31.3	288	100%
11550-41	457	22.0	52 min.	27.1	596	207%

The costs for labor and overhead for running these two parts is approximately equal per furnace-hour, although it costs a little more for the heavier part on account of greater power consumption. There appears no justification for application of costs based on weight, resulting in application of 207 per cent as much cost per furnace-hour for the heavy part as for the light part.

The second study was built around two batches, each of equal net weights, which were processed on carburizing furnaces. One batch had a four-hour carburizing cycle and a nine-hour standard furnace time and the other a five-hour carburizing cycle and a ten-hour standard furnace time. Here is a case where

the pounds processed are the same but the equipment time differs markedly as the following table shows:

Relative Pounds Processed and Relative Furnace Hours for Carburizing Batches of Equal Weights and Different Carburizing Cycle Times

	Standard Time				Relative	Relative
Part No.	Carb Cycle	Total	Net Wght of Batch	Lbs per Hr.	Furn. Hrs.	Lbs Pr'd
83247-42	4 hrs.	9 hrs.	423	47	100%	100%
43250-42	5 hrs.	10 hrs.	420	42	111%	100%

The cost for labor and overhead for operating these furnaces is approximately equal per furnace-hour, so that the cost for the ten-hour batch would seem reasonably to be 111 per cent of the cost of the nine-hour batch. Costing on a pound basis results in application of equal cost to each batch.

In the third case, consideration was given to the fact the pots used for packing of parts for carburizing are of heavy metal and, in many cases, weigh more than the parts processed in them.

Three batches were processed, each of a different weight, so that the net weight of the parts and the gross weight of the pots and parts combined in each load were different. The weights of each batch and the relative weights of each batch for parts and for pots and parts and pots combined, are shown in the table below:

Relative Weights, Gross and Net, Per Batch in Carburizing Furnaces for Parts of Various Weights

	Lbs. In Batch			Relative Weights		
Part Number	21900-80	CS13410-41	01800-06	21900-80	CS13410-41	01800-06
Net weight of pieces	302	404	1,102	100%	134%	365%
Weight of pots	710	710	555	100%	100%	78%
Gross weight	1,012	1,114	1,657	100%	110%	164%

In looking at these figures, it must be remembered that it costs as much per pound for heating up the pots as for heating up the parts. Assuming that all three batches were carburized in the same number of furnace-hours and assuming that the cost for each batch varies directly with the number of pounds, the cost for the heaviest batch would seem logically to be 164 percent of the cost of the lightest batch, but application of cost to net weight of pieces processed results in cost for the heaviest load of 365 percent of the cost applied to the lightest load, two and one-half times the actual cost difference.

In the fourth and last study, two different parts, each of approximately the same cubic area, one having a light wall and relatively light weight and the other a heavier wall and relatively heavy weight, were carburized in two different batches. Assuming that each batch required the same number of furnace hours,

the cost for labor and overhead for each batch might be expected to be approximately equal, although it would cost more for power for the heavier load. However, application of costs on the basis of pounds processed results in assignment of 140 percent as much cost to the batch of heavier parts as that applied to the batch of lighter parts, as may be seen from the following figures:

Relative Net Weights Per Batch in Carburizing Furnaces For Parts of Same Cubic Area and Different Weights

		Std. Pieces Per Batch		Std. Wt. Of Batch	
Part Number	Cu In/Pc	Std Pcs	Rel. Area	Net Lbs	Rel. Wt.
CS13410-41	1.54	4.440	100%	480	100%
CS11876-41	1.65	4.200	107%	672	140%

We concluded from these studies (no studies were made on the tempering furnaces as the problems are the same as those on the carburizing furnaces) that application of heat treat costs on basis of pounds processed was not equitable, that the use of this method resulted in a misstatement of product costs and, in the case of our organization resulted in improper charges from the company operating our heat treating department to the associated company.

Standard Data to Apply Pieces Per Furnace Hour Basis

We then decided that the most equitable basis for heat treating costs we were able to devise without undue complication was pieces processed per furnace hour and we proceeded to apply our costs on this basis to the following processes:

Harden in electric furnace — harden in electric furnace, wash, weigh
Carburize — pack pots, carburize, slow cool, sample, weigh, sand blast
Carburize and harden in carburizing furnace — pack pots, carburize and harden, quench, wash, weigh
Harden in carburizing furnace — pack pots, harden, quench, wash, weigh
Temper in tempering furnace — temper, sample, weigh

Setting of standards involved first the setting up of standard data to be used in computing the standard pieces per furnace hour. It is not possible to cover the ground completely. Examples of such data are given in this section of the article. Standard data for production in electric furnaces was tackled first. The manufacturer's specifications for operating the electric furnaces for hardening parts of alloy steel indicates a capacity of 500 pounds per hour at a belt speed of 60 minutes. As the belt has 25 square feet of effective area, the capacity of the furnace is 20 pounds per square foot of belt area at a speed of 60 minutes, which is equivalent to one foot per hour. On the basis of these figures, standards were computed for belt speed and for square feet of belt area for loading

of various numbers of pounds per square foot of the belt area. Loading of the belt was determined by the nature of the parts and speed of the belt was determined by the time needed for proper hardening. These standards developed are shown below, from which it was possible to convert production volume into standard time for it:

Electric Furnaces

Std. Belt Speeds At Varying Weights Per Sq. Ft. of Belt and Sq. Ft. Per Hour At Varying Belt Speeds—Alloy Steel

Lbs per Sq Ft of Belt	Belt Speed	Sq Ft of Belt Per Hr. (Net)	Lbs per Sq Ft of Belt	Belt Speed	Sq Ft of Belt Per Hr. (Net)
0 -16.00	50 min.	28.2	19.01-19.33	58 min.	24.3
16.01-16.75	51 "	27.6	19.34-19.66	59 "	23.9
16.76-17.25	52 "	27.1	19.67-20.00	60 "	23.5
17.26-17.60	53 "	26.6	20.01-20.40	61 "	23.1
17.61-18.00	54 "	26.1	20.41-20.80	62 "	22.7
18.01-18.33	55 "	25.7	20.81-21.20	63 "	22.3
18.34-18.66	56 "	25.2	21.21-21.60	64 "	22.0
18.67-19.00	57 "	24.7	21.61-22.00	65 "	21.7

In addition, studies were made and standard data set up for methods of loading parts on belt and for computing pieces per square foot of belt area for parts loaded on belt by different methods.

In working up standard data for carburizing furnaces, it was found that the number of pieces of a given part in a batch that could be packed in a pot, varies with the method of packing and the external dimensions of the piece. A study was made of packing pieces in pots and this gave us information such as that displayed in the table below:

Carburizing Furnaces

Relation of Actual Pieces to Theoretical Pieces Per Pot For: Packing A Part by Different Methods (Item 1) and for Packing Parts of Different Sizes (Items 2 and 3)

Item	Part No.	O.D.	Width	Cu In/Pc	Theoretical Pcs/Pot	Actual Pcs Per Pot Loose	Actual Pcs Per Pot Stacked	% of Theoretical Loose	% of Theoretical Stacked
1	CS41340-41	1.50"	.63"	1.42"	1,270	900	1,250	71%	98%
2	01030-80	.87"	.134"	.102"	18,000	16,300	—	90%	—
3	CS07980-80	2.04"	.267"	1.111"	1,630	—	1,830	—	112%

It should be noted that two methods of packing are considered. In respect of Item 1, the pot would accommodate 900 pieces when packed by one method and the same pot would accommodate 1,250 pieces of the same part when packed by another method. Further, it was found that when two parts of the same type but different dimensions were packed in pots, the pots would accommodate 90% of their theoretical capacity for the small parts and 112% for the larger ones,

COMPUTATION OF STANDARD FURNACE HOURS PER C PIECES

1. Harden - Electric Furnaces

	Line No.	11530-80	61203F-01	61203F-02	12065-01	14045-01	12007-02
Type of Steel	1	Carbon	Alloy	Alloy	Alloy	Alloy	Alloy
O. D.	2	1.42"	1.00"	1.57"	1.58"	1.56"	2.83"
Width	3	.186"	.47"	.47"	.63"	.75"	.67"
Sq. In/Pc.	4	2.010"	1.00"	2.40"	2.40"	2.40"	8.00"
Cu. In. per Pc.	5	.374"		1.13"			
Std. Method on Belt	6	Loose	Loose	Loose	Stack	Stack	Stack
Std. Height on Belt	7	2"	2 pcs.	2"	2 pcs.	1 pc.	3 pcs.
Cu. In. per Sq. Ft. of Belt	8	288.	-	288.	-	-	
Pcs. per Sq. Ft. of Belt:							
1 Pc. High	9	-	144	-	60	60	18
Std. Height	10	770.	288.	250.	120.	60.	54.
Std. Space Factor	11	.60	1.00	.80	1.00	1.00	1.00
Std. Pcs/Sq. Ft. of Belt	12	460	288	200	120	60	54
Lbs. per C Pcs.	13	2.0	4.5	6.6	14.0	28.0	31.2
Std. Lbs. per Sq. Ft. of Belt Area	14	9.2	13.0	13.2	16.8	16.8	16.8
Std. Belt Speed	15	45 min.	50 min.	50 min.	52 min.	52 min.	52 min.
Std. Sq. Ft. per Hr.	16	31.3	28.2	28.2	27.1	27.1	27.1
Std. Pcs. per Furn. Hr.	17	14,400	8,120	5,640	3,252	1,626	1,463
Std. Lbs. Per Furn. Hr.	18	288	365	372	455	455	456
Std. Furn. Hrs. per C Pcs.	19	.007	.012	.018	.031	062	069

2. Temper - Tempering Furnaces

Std. Pcs. per Batch	1	30,000	33,000	13,600	10,000	9,000	3,000
Std. Furn. Hrs. for Batch	2	3.	4.	4.	4.	4.5	5.
Std. Pcs/Furn. Hr.	3	10,000	8,250	3,400	2,500	2,000	600
Std. Furn. Hrs./C Pcs.	4	.010	.012	.030	.040	.050	.167

EXHIBIT 1

due to differences in stacking possibilities. The percentage in excess of 100% is due to the assumption that circular parts are treated as square for purposes of calculation.

After a series of such studies, we set up for the various types of parts, standard data for computing standard pieces per pot. An example of this data is as shown in the following schedule:

Carburizing Furnaces

Standard Data For Computing Standard Pieces Per Pot

Type of Part	Size of Part O.D.	Width	Standard Method of Packing	Standard Space Factor % Theoretical	Short Lot	Net
80	0-1.00"	All	Loose-No Wire	80%	10%	80%
	1.01-1.50	"	"	85%	05%	80%
	1.51-1.60	0 -.300"	"	85%	05%	80%
	1.51-1.60	.301- up	Stack	100%	—	100%
	1.61-2.00	All	"	100%	—	100%
	2.01- up	"		110%	05%	105%

In addition, we made studies and established standard data for furnace temperatures and furnace hours for heating up, cooling off, insertion of load in furnace and removal of load from furnace.

Standard data were set up for tempering furnaces in the same manner as for carburizing furnaces.

The Effect of the New Standards Upon Parts Costs

Once the standard data were completed, we computed the rates for the various heat treat processes for the various parts on the basis of standard hours per hundred pieces. An example of this computation which, in practice, allows reference to underlying data, is shown in Exhibit 1.

We then made further studies and set standards for man-hours per furnace-hour and labor rates per man-hour for production of each type of furnace. We put these new standards into effect and integrated them into our standard cost systems. Simultaneously, we introduced a group incentive system for members of our heat treat department, basing the incentives upon data derived as a by-product of our cost systems.

Improved Production Under Incentives Based on New Standards

Of course, in themselves, the new standards on the basis of pieces per furnace hour, increased the standard cost for some items and reduced it for others. A comparison of labor and overhead costs applied to electric furnace production for lots of parts picked at random, using old and new methods, showed varying effects on different items, but, in general a decrease. On the average, costs applied under new method were 49 percent for labor, 83 percent for overhead and 72 percent for total costs, as compared with costs applied under old method. Similar comparison for carburizing furnace production also showed varying effects on different items. However, unit costs, in general, increased. Average costs applied under new method were 108 percent for labor, 143 percent for overhead and 131 percent for total costs, as compared with costs applied under old method.

In short, as a result of introduction of engineered standards, our standard costs for heat treating processes were materially changed, there being (1) in general a reduction in costs applied to parts processed on electric furnaces and (2) an increase in the costs applied to parts processed on carburizing furnaces, as well as increases and decreases in elements of costs applied to particular parts which, in some cases, ran counter to the increases and decreases in costs applied to groups of parts in general.

That the new standards have served satisfactorily for the incentives introduced, is illustrated by improved productivity in terms of both furnace hours and man hours. A comparison of production per furnace-hour for the periods before and after the introduction of engineered standards and the incentive system revealed a substantial increase.

A comparison of man-hours applied to all production for a given period, using both the old and new methods, showed 52 man-hours applied under new method for each 100 man-hours applied under old method. Actual man-hours for the period showed a slight favorable variance and, inasmuch as variance during the period when original standards were in effect, were slightly favorable on balance, the factor of man-hour variances may be ignored in this comparison. We may then conclude from this comparison that production per man-hour on the overall increased to 192 percent (100 ÷ 52), as compared with production per man-hour before the introduction of engineered standards and incentive compensation. Here again, it was apparent that productivity improved.

As a result of introduction and application of engineered standards and of incentive system of compensation for our heat treat department as a whole, man-hours were reduced by 48 percent direct labor cost reduced by 37 percent and overhead cost reduced by 5 percent. Further, there was brought about a decrease in the number of employees, a reduction in the work week of remaining employees and a 22 percent increase in hourly rates of pay.

Results

In summary, it was determined by our investigations that pieces per furnace-hour is the most equitable basis for application of heat treat costs in our operation—pounds processed is not. It also became clear that engineered standards are necessary for proper measurement of efficiency of utilization of man-power and equipment.

The number of employees, labor hours and labor cost were reduced substantially by application of these standards and of the incentive system. There were other reductions which flowed from this. Overhead costs were reduced through reduction in costs for employee benefits on account of reduction in personnel and in labor hours and through reduction in the number of furnace-hours required. The removal of production bottleneck was accomplished through reduction in furnace-hours required. Through this reduction, possible expansion of heat treat activity is now permitted without purchase of additional facilities.

THE WORKSHOP

Material Handling Overhead Affects Unit Cost

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The theme of this paper is that material handling costs must be recognized as a separate part of overhead and treated individually in developing significant unit costs. A comparative study of the results of analyzing this cost separately, as opposed to including it in a blanket overhead rate, is presented with illustrative figures. Effects on unit costs for inventory, pricing and government contract information are noted.

IT MAY BE QUESTIONED whether the practice of including purchasing costs and receiving and storage expenses with production department overhead, when distributed on a direct labor basis, permit determination of a representative cost for each component of the finished product. In contrast to direct costs, overhead cannot be developed by examination of a supplier invoice, nor has any clock card system been devised to "ring in" such costs. Overhead must be allocated: All of the ingenuity, imagination, and technical skill of the cost accountant must be employed to make sure that the allocation is equitable and reasonable, and that the end result reflects the representative cost of the product or part, whether it be stated on terms of standard cost or actual cost. Although cost is not the sole basis for the establishment of selling prices, it does play an important part. It is imperative that costs should be representative and that all elements should bear the test of reasonableness. There are times, too, when production facilities are insufficient for immediate needs. As a result, outside sources for fabrication of parts currently processed in a plant are often sought. Here again, representative costs against which bids submitted by the subcontractor can be checked, are a prerequisite to guide management decisions. A third and most important factor is the relationship between the direct cost elements. When purchased parts comprise the bulk of the product, from a quantity as well as monetary standpoint, representative costs for individual parts cannot be obtained by relating overhead, particularly the service department costs, to the direct labor elements.

Materials-Related Burden In Labor Based Distribution

It is worthwhile to dwell for a moment on factors which affect the representative character of unit costs as related to burden charged into them. In the experience of the author, analysis of the overhead rates in effect at several war plants during World War II raised doubts as to the wisdom of using a direct labor base for the accumulation of all overhead costs. These plants were primarily devoted to assembly work, although some components were manufactured from basic raw materials, (steel bars, shapes, and aluminum castings). By far the greater number of components were purchased in a finished state and combined into subassemblies. Many others were purchased for the final assembly operation. All costs of procurement, incoming inspection, storage, and in-plant movement, were added to other overhead applied to the direct labor dollar.

The resulting overhead rate percentage was high when compared with rates in effect in most manufacturing plants. The cost of the finished unit may have been reasonably correct, but it is evident that the unit cost of many of the manufactured components was distorted by the inclusion of overhead in the cost of parts on which no work was performed. Further, many contractors were confronted with the problem of determining cost incurred in connection with handling material applicable to cancelled contracts. The conventional methods for applying overhead as a rate on direct labor penalized some contractors who found themselves unable readily to determine material handling costs for items on which no direct labor was performed. At the same time, these contractors were required to justify the overhead rates they had used on completed contracts.

More recent experience in my present company has borne out these doubts. Under the standard cost system in use at the New Holland Machine Division of The Sperry Corporation, the standard costs of materials were based on normal cost of acquisition from normal sources, plus freight. Standard labor costs were predicated on the standard hours (developed by the methods department for each operation and upon which wage payments to production workers were based), multiplied by the standard labor rate for each applicable labor grade. Overhead was applied to the direct labor costs by use of an overhead percentage rate for each production cost center. These rates covered the expenses charged directly to the cost center, plus the redistributed service department expenses and were established for each year after comparing the results obtained by dividing forecast overhead costs by forecast standard direct labor costs with those obtained by dividing past actual overhead costs for each cost center by

standard direct labor absorbed (adjusted for known changes such as general wage increases, etc.). In spite of the thought and care exercised in establishing the standard percentages, the overhead variances were substantial by the middle of the year for each of the cost centers, indicating a common cause.

The unfavorable variances, at the time studied, were due, in part, to decreased production activity caused by a contemplated model change, but there were other factors not so readily discernible. An analysis disclosed that direct departmental overhead contributed considerably less toward the unfavorable variance than the unabsorbed portion of the redistributed expenses and that certain of the redistributed expenses had increased. For instance, purchasing activity and related operating costs had gone up during the period of low productivity, due to the extra effort needed to place orders for future production of the new model. Again, receiving activity had not been curtailed as a result of reduced production, because of the activity in connection with receipt of the parts needed for the new product. The storekeepers were busier than ever, rearranging stock to provide storage area for the new components. Much of the cost of these activities was coming out as overhead variance, especially because of the relatively low direct labor base, occasioned by the reduced level of production.

Segregating "Materials Handling" Costs

The danger signals shown by the overhead variance accounts were heeded. We decided to re-examine our overhead cost determination basis, especially as it concerned costs related to materials. Material handling overhead was defined as the cost of acquiring, receiving, inspecting, and storing materials in their original form. Handling of parts processed and manufactured in the plant was deemed to be an overhead element still chargeable to production on the basis of direct labor. Most of the departments responsible for the functions to be reclassified for burden distribution purposes, performed other tasks which could not be charged to material handling overhead. Consequently, segregation of applicable costs was necessary. All purchasing division expense, except that portion which was related to the procurement of uninventory items, was classified as material handling expense. Receiving department expenses were distributed to other than the production departments in proportion to the service rendered.

The parts warehouses and plant stockrooms rendered no measurable service to departments such as sales and accounting, but a segregation of expense was necessary because these units store and handle both purchased parts and manufactured components. This same situation prevailed in con-

nection with the stores record-keeping departments. However, all of the expenses of the yard department and of the steel warehouse could be included, since their responsibility was confined to receipt, storage and disbursement of materials on which no direct labor had been performed in our plant.

The stockroom responsibility ends with delivery of material to the production department. All movement within the production area is controlled by the material handlers assigned to the production centers. Finished parts go to inspection, thence directly to the assembly lines or to the storerooms. Only items consigned to the storage areas are handled by the stockroom personnel. The cost of movement within the production areas is not included in material handling overhead since it is considered to be directly applicable to the production operation on the basis of direct labor.

Setting Rates for These Procurement and Pre-Process Handling Costs

In the course of the foregoing analyses, we learned what should be eliminated from the overhead applied to direct labor. The next logical step was an analysis of the effect of such elimination on overhead percentages and the reasonableness of costs developed on this new basis.

The standard overhead rates in use covered both production department expenses and the redistributed charges from the service departments. A new overhead rate was obtained by eliminating the redistributed expense of the material handling group from the labor-based rate. The result of this action was a reduction of seventeen percentage points in the overhead rate for each production center, reducing by this proportion and in the categories questioned, the amount of overhead allocated over direct labor as a base. On this calculation (but later refined for the purpose—see further descriptions of this development) the rate for the material handling cost group was intended to be two per cent of the budgeted standard cost of material to be acquired. The effect on the unit cost, comparing a manufactured and a purchased item, is illustrated in the table below:

	Purchased part		Manufactured part	
	Old basis	New Basis	Old basis	New Basis
Material—invoice cost	$6.50	$6.50	$1.00	$1.00
Material Handling Overhead 2	0	.13	0	.02
Direct Labor Cost	0	0	2.00	2.00
Production Overhead	0	0	3.50	3.16*
Total Factory cost	$6.50	$6.63	$6.50	$6.18

* Overhead rate of 175 per cent reduced to 158 per cent by eliminating material handling costs.

DISTRIBUTION OF MATERIAL HANDLING COSTS
Material Handling Costs

	Total	Plant Storeroom	Warehouse	Yard and Steel Whse.	Purchasing Division	Receiving Dept.	Overhead Percentage
Budgeted Expenses	$273,000	$ 42,600	$ 62,500	$ 33,000	$102,000	$ 12,900	
All - Undistributed Expenses	20,000	10,400	7,500	1,000	1,000	100	
Total	$293,000	$ 53,000	$ 70,000	$ 34,000	$103,000	$ 13,000	
Less - Expenses Applicable to other operations	43,000	20,000	17,500	-----	5,000	500	
Total	$250,000	$ 33,000	$ 52,500	$ 34,000	$ 98,000	$ 12,500	
VALUE OF MATERIAL HANDLED (IN THOUSANDS OF DOLLARS)							
	Budgeted Purchases						
Raw Materials	$ 1,500	$ -----	$ -----	$ -----	$ -----	$ 1,500	
Paint and Oil	200	-----	-----	-----	-----	200	
Castings	1,500	500	500	-----	-----	1,500	
Engines	2,500	-----	-----	-----	-----	2,500	
Rubber	1,000	300	-----	-----	-----	1,000	
Hardware	500	300	300	-----	-----	500	
Purchased Parts	5,500	5,500	5,500	-----	-----	5,500	
Total	$ 12,500	$ 6,600	$ 6,300	$ -----	$ -----	$ 12,500	
DISTRIBUTION OF MATERIAL HANDLING OVERHEAD TO INVENTORY CATEGORIES AND DEVELOPMENT OF PERCENTAGES TO BE APPLIED							
Raw Materials	$ 66,500	$ -----	$ -----	$ 30,000	$ 35,000	$ 1,500	4.4%
Paint and Oil	5,800	-----	-----	4,000	1,000	800	2.6%
Castings	35,500	2,500	2,500	20,000	9,000	1,500	2.4%
Engines	20,500	-----	13,000	-----	5,000	2,500	.8%
Rubber	13,500	1,500	8,000	-----	3,000	1,000	1.4%
Hardware	8,300	1,500	1,500	-----	5,000	300	2.7%
Purchased Parts	100,500	27,500	27,500	-----	40,000	5,500	1.0%
Total	$250,000	$ 33,000	$ 52,500	$ 54,000	$ 98,000	$ 12,500	2.0%

NOTE: Budgeted expenses and distribution of material handling overhead to inventory categories - expressed in dollars.

EXHIBIT 1

To the extent cost plays a part in the establishment of selling price and if price policy decrees a list price of twice the standard cost for parts manufactured to our specifications, we would thus find that two parts which formerly sold at the same price were now priced, using the above data, at $13.26 for the purchased item as against $12.36 for the manufactured component. In all probability, the price of the purchased item could be increased without jeopardizing sales volume and there is no doubt that the competitive position would be improved for the manufactured part.

As to a decision to make or buy parts, factors other than cost may motivate it, but such action is often influenced by a comparison of cost to make with quotations from suppliers. Under the old method of allocating overhead it would not matter, from a cost viewpoint, if the part used in the example were made or bought (providing, of course, that production facilities would be used to the extent forecast). When material handling overhead is properly allocated, as under the new method, the decision to make or buy may still be predicated upon production needs, but management will be aware of the real effect of such action from a cost standpoint.

Other advantages resulting from use of a material handling rate are:

1. The production departments will not bear the burden of increased purchasing costs due to tight market condition.
2. The cost of setting up and maintaining additional storage facilities will be charged to all production parts stored

there rather than manufactured items only.

3. The material handling overhead costs will be absorbed as material is received, thereby avoiding production overhead variances when production is curtailed for model changes or for any other period of productive inactivity.

The rate for absorbing procurement and materials handling costs on the base of invoice cost was not finally determined as two per cent there were special factors, varying with materials, to be taken into account. Although satisfied that the reduced overhead percentages on direct labor were appropriate, we did not feel that a two per cent rate applied to standard value of all materials purchased would produce the desired representative costs. For example, no more effort was required to purchase a thousand bearings to be inventoried at several thousand dollars than was expended to purchase a thousand bolts and nuts, worth fifteen dollars. By the same token, receiving department expense allocation could not be covered by a single across-the-board percentage. Handling costs on steel varied considerably from similar costs for rubber tires and belts. In addition, inside and outside storage presents a problem in allocation of warehousing expenses, which cannot be solved by application of a single rate to the inventory value of the items stored. It was obvious that further study was required in order to arrive at material handling overhead rates which would produce the desired reasonable costs.

Plant inventories were already separated into major categories. Examples are: material, engines, castings, purchased parts, rubber, etc. These categories had been set up for accounting purposes and determination of variances. Inasmuch as annual requirements for each category were budgeted separately, it was decided to attempt an allocation of material handling overhead costs to these categories on a per dollar of standard cost basis, to arrive at the appropriate percentage for the category. The development of these rates is the subject of Exhibit 1.

The uppermost of the three sections of the Exhibit sets forth budgeted expenses for all categories, less these relate to services which the purchasing division and receiving departments perform for other divisions and departments and also to amounts deducted from the budgeted expenses of the plant stockroom and warehouse, representing a fair estimate of the material handling cost which would be incurred in connection with the handling and storage of parts manufactured or assembled in the plant. The middle section of the exhibit concerns the value of material handled and is designed to provide the dollar base for allocation of certain material handling expenses, in terms of total forecast purchases. In the bottom section of Exhibit 1, the distribution rates are worked out; by dividing total expense dollars by the budgeted purchases in the total column of the value of material handled

REDISTRIBUTION OF INVENTORY VALUES

	Inventory Per Books	Work-In-Process Parts	Work-In-Process Fin.Units	Finished Units	Manufactured Parts	Adjusted Inventory	M.H.O. Rates %	M.H.O. In Inventory
Work-In-Process - Parts	$ 300	$ ---	$ ---	$ ---	$ -----	$ -----		$ -----
Work-In-Process - Finished Units	150	---	---	---	-----	-----		-----
Finished Units	100	---	---	---	-----	-----		-----
Manufactured Parts	1,000	---	---	---	-----	-----		-----
Redistributed to:								
Paint and Oils	70	---	---	1	-----	71	2.6	1,846
Castings	300	30	8	8	110	456	2.1	10,096
Engines	800	---	---	15	-----	815	.8	1,720
Rubber	600	---	5	6	19	630	1.4	6,020
Hardware	100	3	2	2	10	119	2.7	3,213
Raw Material	500	56	12	10	270	882	4.4	37,048
Purchased Parts	1,500	85	73	35	314	2,009	1.8	36,162
Labor	-----	96	16	10	100	176		-----
Overhead	-----	30	34	13	177	354		(29,980)*
Total	$4,620	$ 300	$ 150	$ 100	$1,000	$6,620		$66,985 **

NOTE:

1. All values hypothetical.
2. Inventory values in thousands of dollars.
3. Material handling overhead in dollars.

* Overhead - 17% of direct labor ($176,000).
** Net increase in inventory value.

EXHIBIT 2

section. Analysis of the overhead percentage column supports the contention that two per cent, as a material handling rate for all types of materials, would not produce representative costs. Items manufactured from raw materials would be favored while engines, rubber and purchased items would be penalized.

It will be apparent that the foregoing description of Exhibit 1 is centered on the development of the overhead rates for the several types of materials. The manner in which the stockroom, warehouse, yard and other expenses were allocated to materials classification has not been taken up in detail. Difficulties were encountered, but the point here is the necessity of the distribution; to obtain usable rates. Every company will encounter the distribution problem in a characteristic way. In order to accomplish this, we analyzed all inventories as to process or finished status, as shown in the upper portion of Exhibit 2, and by use of a sampling technique, further broke them down to classifications conforming to the material handling rate categories, as shown in the lower portion of this exhibit. It was possible to base the distribution factors on ten per cent of the items in each element of inventory, since the value of these items approximated seventy per cent of the inventory value. The result was a net increase in inventory valuation representing the application of the new overhead rule to inventory categories, less decrease in overhead as previously applied. It will be apparent that this reduction represents the change in regular overhead rates of 17 percentage points, as previously

worked out in this paper, when materials handling overhead was separated.

Calculating Variance for the Segregated Costs: Paperwork Procedure

It was felt that a single material handling overhead variance account would serve. The appropriate portion of the expenses of the material handling departments could be charges to this account and it could be relieved for the amount of standard material handling costs charged into the inventory. Any balance would represent a favorable or unfavorable material handling overhead variance. It was necessary to compute material handling overhead costs for each item when setting new standards, since material handling costs were to become part of the standard cost of each item contained in the inventory. The increased man-hours required for this operation caused no concern, but we were perturbed about the number of calculations which would be required to relieve the material handling overhead variance account on the basis of individual receipts of purchased items.

We hit upon a rather simple solution to the problem. The actual acquisition cost of material was, under our regular practice, charged to the material price variance accounts. There is one for each category of material. These variance accounts were relieved on the basis of the standard inventory value of the individual items received. Since standard inventory value now included basic material cost plus material handling overhead, the relief was excessive. To correct this condition, factors were developed for determining the amount to be relieved from the material handling overhead variance account and charged back to the appropriate price variance account.

The actual computation was simple and required only a few minutes' work each month. The standard inventory value for each category was divided by one hundred, plus the appropriate material handling overhead percentage. The result of this computation was subtracted from the standard inventory value, to obtain the amount of material handling overhead to be credited to the variance account and concurrently debited to the price variance account. The effect of this procedure on the books is illustrated below:

Actual acquisition cost of raw material—	$103,000
Less: Standard value charged to inventory—	104,400
Price variance on original transactions—	($ 1,400)
Standard value charged to inventory	$104,400
Less: Basic standard cost value— $\frac{\text{Standard Value}}{100 + 4.4\%}$	100,000
Amount credited to material handling overhead variance account and debited to price variance account	$ 4,400
Adjusted price variance ($4,400 less $1,400)	$ 3,000

Note: Since this paper was written, this variance procedure, although effective, has been supplanted by another. A tabulating application involving the use of pricing decks containing the standard basic material cost and material handling overhead costs for individual items is now used. Inventory values, purchase price variances, and the amount to be relieved from the account are developed on an individual basis, mechanically.

Experience Has Proven the Advantages

The material handling overhead rates have been in use for several years, and we are convinced that their use produces the desired results. The procedure and applications are constantly surveyed, with work simplification and adequacy of coverage as the objectives. These surveys have revealed some significant facts which justify the application of material handling costs rates to a purchase price rather than to direct labor expended in production. The purchasing division has expanded beyond normal expectations, due to the extra work load imposed by government regulations and record-keeping required in connection therewith. Increased sales volume has increased the number of purchased parts, while plant facilities for manufacturing remained comparatively static. Additional storage facilities have been built and manned to facilitate handling. Subcontracting with its attendant excessive movement has also increased. Changing conditions have necessitated increasing the materials handling rates. In some categories the increase has been as much as fifty per cent of the rates originally established. We were glad we could recognize these changes, as permitted by the new basis of charging this type of burden.

The decision to apply material handling expense on the basis of purchased cost of the items rather than the direct labor cost, is not one to be made lightly. All factors must be weighed carefully. The effect on inventories and the soundness of costs so developed must be considered. It is our opinion that the advantages far outweigh the costs of establishing and maintaining this program.

The premises on which we base this conclusion are outlined below:

1. The costs developed are more representative and thus:
   a. Provide a reasonable base for establishing selling prices or, at least, prove the profitableness of selling prices established otherwise.
   b. Facilitate cost comparisons of quoted prices for parts or subcontract services, with an individual parts base which is not influenced by improper distribution of elements of cost.
2. Factory departmental overhead rates are more realistic, because they have not been charged with costs incurred in connection with parts on which no productive effort has been expended.
3. Changes in the productive cycle are not influenced as under conventional overhead distributing by costs incurred in connection with future programs.
4. Material handling costs, in excess of established standards, are highlighted by a single control, i.e., the material handling overhead variance account.

Finally, it may be said that a sound basis for allocation of material handling costs is necessary for manufac-

turers engaged in defense work, particularly those who use part of their facilities for production of their civilian output, if they wish to avoid the difficulties which accompanied contract settlement and termination during World War II. Failure to provide an equitable base for allocation of material handling overhead can mean losses which can never be recovered.

Practical Engineering of Burden Distribution

by EDWARD WAYGREN

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This paper deals with the problem of burden distribution in terms of the measurements and analyses necessary to get maximum accuracy compatible with reasonable cost. Correlation of costs with the pertinent variable and the necessity for practical approximation are emphasized. As an example of the required techniques, distribution of an electric power bill and development of burden rates for plastic molding are discussed.

A COST SYSTEM IS ONLY AS SOUND as the distribution of burden permits it to be. This truth applies especially to job shops. Since almost all their business is taken (or lost) on the basis of advance quotations, the success or failure of such an enterprise is largely dependent on the soundness of the estimating procedure. It is not safe to assume that any given method of burden distribution is "accurate enough."

How shall we make distribution of burden more accurate? More and more, it is necessary for the cost accountant to work with the plant engineer to establish proper bases for such distribution. Often difficulty is experienced because the accountant and the engineer speak a different language. For this reason, the cost accountant must familiarize himself with the engineering problems involved in developing sound distribution of burden. It is important to note that he should only recognize the problems. The solution must still come from the engineer. On this thought, then, the present article is based. It consists of two parts, each illustrative, which discusses in turn distribution of an electric power bill and development of burden rates in the compression molding department of a plastics molding plant.

DISTRIBUTION OF ELECTRIC POWER BILL

Distribution of a power bill is an example of a burden problem which is usually disposed of in a somewhat arbitrary fashion, particularly in a smaller plant. This happens because

it seems impossible to achieve accuracy in power distribution unless departmental meters are used and rarely does the expense bulk large enough to warrant the cost of meters. However, the proper distribution of power expense may be extremely important to the job shop, particularly when one or more of the departments may use an appreciable portion but not necessarily most of the power. Improper allocation affects the machine hour rate of such departments and thus contributes an error to whatever estimates are made. A method of distributing a power bill which has been highly successful is the one outlined here.

The method originated in a particular job shop. In this plant, the use of electricity for lighting accounted for about 20 per cent of the bill. In trying to determine the power requirements, difficulty was experienced because of the lack of dependable data on which estimates might be based. For example, three machines in one department were powered with a 20 h.p. motor each, but previous tests had shown that these motors "pulled" over 100 amperes on a 220-volt line or about 28 h.p. for an appreciable portion of the operating cycle. This situation prevailed when a booster was operating to close the press. However, after the booster cut out, the motors ran at perhaps two-thirds of rated load, but, when the estimate of two-thirds of rated load was used to determine the theoretical monthly consumption of power, no correlation with actual consumption could be found.

Study of Consumption and Correlation With Operations

A way had to be found to determine consumption by units of equipment, for the same lack of information existed in regard to other electrical equipment in the shop. Inasmuch as such information is needed, not only to distribute power expense but also to apply costs to the products, a portable kilowatt-hour meter was used to determine actual loads on various key machines. The meter was attached at the panel board to each of the machines in each department in turn. It required no attention except periodic reading and occasional re-attaching to other machines. Hence, the man-hours used in making the study were negligible.

In thus measuring power consumption as a function of operations going on during the study, an attempt was made in each department to correlate it with some known productive factor. For example, in one department it was felt that consumption might be related, in some degree to one or more of the following factors: number of pieces produced, pounds of material processed, number of hours of operation, horsepower of motor and capacity of machine. In following these leads, a series of studies

was made, several on each machine while different jobs were running. Each study was entered on an analysis sheet which provided for posting press number, horsepower, capacity, elapsed hours, KWH used, pieces produced, and pounds of material processed. Calculations were then made which resulted in the following data:

1. KWH/Hour of operation.
2. KWH/Piece produced.
3. KWH/Lb. of material.

Analysis for this department showed that, for practical purposes, only one relationship existed which remained fairly constant, regardless of variations in operating conditions. This was the consumption in kilowatt hours per machine-hour. In a given group of machines, this consumption figure varied between two set limits, regardless of how the various operating factors changed. It is worthy of mention that later test checks revealed that actual consumption did not go beyond the bounds indicated by the studies. The reason for this satisfactory result was that the figures developed by the studies were not predicated on ideal conditions, but included the effects of all types of operating conditions short of complete breakdown.

Determining Distribution Rates

The next problem was to determine which type of grouping of items of equipment would result in the smallest variation between extremes. Although it was found that a high degree of correlation existed in groupings by horsepower and by capacity, individual differences among machines of same size and type were great enough to warrant development of rates for each press. However, in other departments, with smaller variations and larger numbers of machines, it was found that grouping of the machines resulted in acceptable accuracy.

The ultimate result was a consumption rate in kilowatt hours per hour for each machine in the four departments in which power might be charged properly on a machine-hour basis. In one department, because of the variety and number of small machines, power rates were correlated with direct labor hours rather than machine hours. Each of the consumption rates was multiplied by the cost of electrical energy per kilowatt hour, which fluctuated very little from month to month. The resulting factor simplified clerical operations and had to be changed only when there was a large change in sales volume or when the billing rate of the local utility changed.

Computation of the proper power distribution, using these factors, still left an undistributed remainder of the power bill for nonmachine departments. This residual amount was distributed on a percentage basis against each of the remaining departments.

The percentages were developed in the following manner. Data derived from the power studies were compiled so as to give a consumption rate per hour of department operation, which included lighting, fans and small equipment. This rate was multiplied by the operating hours and the resulting charge was expressed as a percentage of the remainder of the power bill. The procedure embodied in the foregoing steps was repeated until distribution had been made of three months' bills. When the results were tabulated, percentages for each month showed sufficiently close correlation to warrant computation of an average percentage for each department.

The importance of the method of power distribution which has been described lies in the fact that it is performed in a short time, once each month. In addition, the largest portion of the power expense is accurately distributed by machine hours to each department and is based on the actual production going through the department. The advantage of applying this expense on a production basis, instead of on a percentage basis, is that any variation in the nature of the production in a department will at once be reflected in the overhead. The use, month after month, of a fixed percentage distribution tends to distort the true cost picture.

DEVELOPMENT OF MACHINE-HOUR AND HEAT RATES IN COMPRESSION MOLDING

Although it is rarely possible to distribute burden accounts with complete accuracy at all times, it is almost always possible to increase the accuracy of distribution and thus provide, as an end result, better estimating rates. Generally speaking, the best method to be followed in applying burden to production is one directly related to the way in which the particular expenses were incurred. For example, there is no question that the burden base for a hand assembly department is the man-hour or that, in an injection molding department, it is the machine-hour. In hand assembly operations both expense and output are directly related to man hours. In injection, regardless of the man-hours on the pay roll, costs and production are governed by the number of machine hours.

However, in compression molding the situation is not clear-cut. Moreover, the practice which is generally followed is to apply overhead, (sometimes designated as a press charge) as a percentage of labor cost. The fallacy here is that direct labor unit cost in molding is generally dependent on the amount of bench time in a cycle, so that labor hours bear no relation to the machine hours. Each should be costed separately. There are not only two but three distinct factors entering

into the burden cost of molding: the man-hour, the machine-hour, and the heat. In other words, costs are incurred and should be applied on three different bases, none of which necessarily bears any relation to the others. To attain any degree of accuracy in estimating, it is important that these basic units be evaluated individually.

An example of how a simple and inexpensive analysis resulted in better costing and estimating in the compression molding operation is offered in this section of the present article.

In so doing, attention will be focussed on the importance of developing a machine-hour rate, to cover expenses to which a direct labor rate is not applicable and further separating from the machine-hour rate, a heat rate. Because most machine-hour rates are constructed to distribute many different expenses, few of which are large in themselves, a rather arbitrary procedure is often followed in distributing the various burden accounts covered by the rate. Usually there are two reasons. The amount is not important enough for more painstaking treatment. Accurate distribution would cost too much. Often, however, these contentions turn out to be rationalizations, the real reasons for failing to seek better results being unwillingness on the part of the cost accountant to do a creative job or management's ignorance of how cost accounting can be improved through application of common sense and engineering fundamentals.

Establishing Separate Machine Hour and Labor Rates

In the first place the machine-hour rate, to be effective, cannot include any elements of expense which are not directly related to cure time as contracted with those related to bench time. The first step therefore, is to analyze all manufacturing expense accounts to classify them into two groups, as being either man incurred or machine incurred expenses. When this is done, it will be possible to divide the total of the machine incurred expense accounts by total machine-hours to arrive at a machine-hour rate. The man incurred expenses, on the other hand, will be divided by total man-hours, and a man-hour rate will result.

The man-hour rate may be expressed as a percentage of direct labor, if that is the company practice. However, if labor is paid at piece rates, this percentage must rely on the base rate used for estimating, rather than on earned rates.

In establishing the machine-hour rate, it is necessary to clarify the term, machine-hour. It may mean the time that a press is in use for productive purposes, including cure time, opening and closing movements, and occasional idle time, or it may mean productive, or cure time only, allowance

being made for press movement. The idle time would probably be due to "soldiering" on the job or to inefficient mold hook-up. In this second interpretation, however, the machine-hour may still contain idle time, since a piece may be over-cured. As far as machine utilization is concerned, this is as unproductive as if the press were allowed to stand open. Therefore, a still finer definition of machine-hour would include only the necessary, or standard, cure time, eliminating over-curing as idle time. This is the machine hour to be used for estimating and cost purposes, because it is the cure time only which can be costed.

The effect of using this machine-hour will be to prorate the cost of idle time, which is a practical way of absorbing this cost. Costing a machine-hour which includes anything more than standard cure time would require that idle time in a cycle be estimated. This would, of necessity, be an arbitrary figure and would not take into consideration the possibility that the idle time or over-cure of one mold might be due to the unusual combination of bench and cure time of another mold. Of course, this would occur only in those plants where a molder regularly operated more than one mold or press.

Separating the Per Heat Rate, as with Steam Cost

Recognizing expense to be covered by a machine-hour rather than a labor-based burden rate may be only a start. The machine-hour rate may need refinement. The significant question which arises is whether such rates may be regarded as fixed when set or whether they will vary with the number of heats molded in an hour, thus indicating need for an additional rate. It is readily apparent that it costs more to run a press with a one-minute cure, which opens and closes sixty times each hour than one with a five minute cure, which opens and closes only twelve times an hour. The problem is to give effect to this costing, especially in connection with the estimating.

Steam cost is the best illustration. In a plant with an accumulator system which was run by steam pump, it was necessary to begin the study in the boiler room. It was found that the steam generated in the boilers was used for heating the building, operating the pumps which maintain pressure in the accumulator, and heating the press platens, molds and molding powder. In attempting to establish an equitable and flexible distribution procedure, consideration was given to each of the possible methods for measuring steam consumption. Installation of departmental flow meters would have provided fairly accurate departmental distribution, but the problem of applying steam cost to jobs would still remain. This might be accomplished either by installing additional steam flow meters, measurement of condensate, or estimate. However,

meters are of little value in measuring accurately the small amount going into a press, and the cost of such an installation would be prohibitive. Reliance on an estimate, on the other hand, without exploring the problem further, might well nullify any accuracy which would have been gained up to this point.

Measurement of steam condensate is a method which might be adequate if all factors were sufficiently controlled. However, such a procedure under production conditions, would be impractical for many reasons. The studies would have to be extended over a long period, so that such factors as length of heat, size and construction of mold, quantity and type of material, among others, could be plotted against the amount of condensate, in order to determine their relative importance. Condensate in the lines might empty through individual press steam traps, introducing an unknown discrepancy. The manner of redistribution of steam expense incurred by the pumps could not be ascertained by these means. In addition, inability to allocate properly line losses, or losses through radiation, would result in appreciable errors. Probably the most important consideration was that, even if accurate data were accumulated, the resulting complication of distribution procedure would be self-defeating.

It became obvious that basing distribution on any of the foregoing methods would be undesirable. Practical considerations indicated that striving for unattainable accuracy should be subordinated in favor of a workable routine that is essentially simple. It was, therefore, decided that a satisfactory and practical solution might be attempted on the basis of observation, mathematics and logic. The steam used for heating was disregarded because it represented a small portion of the total and because any adjustments for seasonal variation would thus be eliminated. The steam used in manufacturing was divided into the following types of consumption:

1. Line losses
2. Maintenance of platen heat
3. Operation of pumps
4. Amount in excess of that needed to heat molds and cure powder

Line losses were disregarded, as a practical matter. Therefore, its cost was spread in proportion to the charges to production. The maintenance of platen heat is a constant. However, consumption in Categories 3 and 4 varied in direct proportion to the number of heats, and was nonexistent when the plant was not in production. Hence heat at idle hours represented, for practical purposes, platen heat alone. The plant was normally idle for a twenty-four-hour period (Sunday) each week. During this time, heat was maintained in the molding presses but not up to production tem-

perature. Although the difference between production and stand-by temperatures resulted in an estimated decrease in coal consumption of about ten to twenty per cent, it was felt, in the interests of simplicity, that this variation could be safely ignored.

Therefore, an index of steam consumed by maintenance of platen heat alone, including line losses, was determined by computing the weighted average of coal used on Sunday. The weighted average of coal used on production days indicated the total necessary for platen heat, line losses *and* production. The coal figures were also plotted against daily mean temperatures and Sunday consumption was expressed as a percentage of weekday consumption as follows:

Mean Temperature, °F	Sunday Coal Consumption as Per Cent of Weekday
20	44
25	41
40	38
45	36
55	34
60	31

Because of the relatively few days throughout the year at the lower temperatures, 35 per cent was estimated to represent consumption to be regarded as "fixed" steam expense. In other words, 35 per cent of the steam expense incurred during a production day is not a direct charge to production. It is more in the nature of a stand-by cost and may be distributed on a machine hour basis. In brief, it is a suitable component of a machine hour rate. The remaining steam cost is incurred through operation of the presses, and should be distributed over total heats molded.

The separation of steam expense into hourly and heat rates was accomplished by dividing the power cost center into two new cost centers, the boiler department and the pump department. The setting up of the latter cost center thus made possible the accumulation of all costs which could properly be applied on a per heat basis. One of the production forms reported number of heats. It was thus necessary only to recapitulate those forms monthly and divide the result into total expense to ascertain actual cost per heat.

THE OBJECTIVE

The two parts of this paper, that dealing with the distribution of electric power expense and that dealing with recognition of the need for three rates in distributing compression molding burden (and utilizing steam expense as illustrative of a category properly distributed in part by a heat rate) form one presentation in that they draw attention to the possibilities which exist for better burden distribution for price estimating and other costing purposes. The importance of such improvement is major, especially in job shops, and requires not only accounting but engineering techniques as well—and the cooperation and joint endeavor of the engineer and accountant.

Budgeted Volume: Burden Base for Seasonal Operation

by WILFRED F. NEUMANN

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This paper reviews the reporting problems and the significance of overhead distribution in seasonal industry. It compares the effect of the normal and actual basis for burden distribution when the seasonal variation is a major factor. It then notes the advantages of the normal method for planning, making alternative decisions, and arriving at the most useful and significant product costs under seasonal conditions.

MANY ARTICLES OUTLINING METHODS of overhead application have appeared in recent accounting literature. Most of these methods, such as physical units of production, direct labor hours, machine hours, net sales volume, or contribution to gross margin are basically related to actual volume of production in one way or another. As such, they are not wholly unrelated to the article by Robert W. Cherry in the September, 1952 issue of *N. A. C. A. Bulletin,* entitled "Beneficial Costing for Milk Products," in which was outlined a method of overhead distribution based on normal volume of production in the fluid milk industry. The present article deals with an application of the normal volume method of burden absorption to another highly seasonal industry-vegetable canning.

The Company and Its Operation

To furnish background for the problems and the solutions worked out, a brief description of our company and operations is given. The Green Giant Company is a vegetable processing company, the basic products being peas, corn and asparagus. Processing operations begin in early April on asparagus and continue into October for corn. Quality of product, style of pack and tin size variations result in approximately fifty individual items.

We operate twenty-four plants in seven states scattered geographically across the northern part of the United States. For better local control, all operations are organized on a divisional basis along geographic lines. Some plants are single commodity plants operating for as few as twenty-five days during the year and canning a hundred thousand cases. The largest plants operate no more than seventy-five days. However, they may process ten to twelve times as much as the smaller plants.

Since the history of the company has been one of continued growth, the annual production at each plant has been budgeted at or near capacity for the anticipated period of operations. Control of the quantity available for processing is achieved by con-

tracting in advance with farmers to plant a specified number of acres. The date of planting is also specified in the contract to maintain control over the period of planting. Furthermore, the crop is generally harvested by equipment owned by the company. This gives us efficient flow and constant supply of raw produce during the canning season and also results in control of quality in the finished product. In areas in which we cannot obtain sufficient contract acreage, we lease the land and perform the farming operations with our own equipment and employees.

In spite of this close control over the production of the raw produce, the annual pack at any location may vary from sixty to one hundred fifty per cent of the budgeted production. Weather is the major reason for these wide variations from year to year. For example, extreme heat may ruin a promising crop of peas in a few days.

Complete and Accurate Reports Provided Promptly

Since production is so highly seasonal and sales and distribution extend throughout the year, monthly and quarterly closings are unnecessary and meaningless. However, a complete and integrated cost accounting system has been developed. This is basically a process cost system, with comparisons made against standards as developed in the annual operating budget. Variances from these standards are calculated and analyzed but are not recorded in the accounts.

The various types of cost reports can be classified broadly as follows:

1. Daily reports on harvesting, vining, insect control and direct factory labor prepared during the operating season.
2. Monthly reports on labeling and shipping, capital and repair expenditures prepared throughout the year.
3. Reports covering such operations as various phases of our farming, restaurant, housing, seed growing and processing, and pepper processing, prepared during the year according to a definite schedule.
4. Summary cost reports on each type of pack prepared and completion of the pack. These summary reports cumulate the figures from the daily reports, correcting for errors which inevitably enter the latter, adjusting for over or under absorbed overhead and presenting an over all picture of the pack operations.

Two of the major aims of our cost reports are to permit issuance of complete and accurate costs, as quickly as possible. Speed and accuracy are especially important in cost reports in the canning industry where the entire production period is a matter of days. Warehouse space is generally limited, necessitating shipments to the trade as quickly as possible. Also, the industry is highly competitive, early shipments thus being essential to get shelf space in retail outlets. Consequently, sales prices must be established within a few days after packing operations begin, as the shipping schedule is usually heavy at that time.

The daily cost reports issued during operations, serve to illustrate the way in which data are worked up and submitted on an exceptionally rapid basis. Detailed individual reports are first

prepared for various operations, such as harvesting, vining and direct labor, and are combined into one summary report. This brings the day's operation down to a net profit or loss for each plant, compares the various items of costs, sales values and margin with the predetermined standards, and analyzes the variances in terms of operating efficiency, raw produce yields and quality of finished product. The report involves staff at all company units.

The bulk of the detailed figures and reports are compiled at the local plant after the day's operations are complete. They are then sent by messenger or telephone to the division office. The summary report is completed at the division office and sent by teletype or telephone to the company headquarters, by 2:30 p.m. of the day following pack, if on schedule. The division reports are then combined into a company report which we try to have completed, typed and distributed by 4:30 p.m. of that day. It shows the same detail as the divisional reports and, in addition, contains operating data and production quantities on a cumulative basis throughout the period of the pack.

In preparing the reports, the direct costs, such as raw produce costs, harvesting, vining, shelled pea trucking, direct factory labor, and condiments, can be measured very accurately during the packing season. Packing costs, including cans, boxes and labels, are included in the reports at standard costs developed in the operating budget. Although these two cost categories constitute about three-fourths of the total cost they do not furnish sufficient information for pricing. The remainder of the costs must be absorbed as overhead costs. They are the principal subject of this paper.

Overhead Categories; the Development of Normal Production Figures

We classify overhead into four major groups.

1. Field overhead consisting, largely, of field supervision salaries and expenses, repairs, maintenance and depreciation on field equipment, such as harvesters, viners, etc.
2. Local factory overhead consisting of local supervision, local office expense, communications, production machine rentals, taxes, insurance, repairs, depreciation, etc.
3. Division overhead consisting of division supervision, division office salaries and expense, division engineers, etc. These are all costs which are chargeable against a number of plants and commodities at those plants.
4. Top company level administrative costs which must be borne by all plants and then apportioned to the various commodities produced.

Since these overhead costs constitute more than twenty-five per cent of the total cost of our operation, it is imperative that an accurate allocation of them be included on a current basis.

The most logical method of overhead allocation and the only method I have ever seen advocated for the canning industry is related to volume of production in one way or another. For many years, we used equivalent units of production for distribution of overhead. Each tin size of a commodity was reduced to a common denomi-

nator on the basis of the quantity of raw product in the can. Similarly, the production of all commodities was reduced to a common tin size. All overhead was then allocated on this equivalent volume of production.

About five years ago when the operations were set up on a divisional basis, it was decided to distribute all company general overhead on a normal budgeted production rather than an actual production basis. After a year or two this method appeared satisfactory and plans were made to distribute all overhead on this basis. This program is tied in directly with our annual operating budget. As soon as the current pack is completed, or early in the fall, we begin compiling data and preparing the next year's operating budget.

One of the basic steps is establishing normal yields for each variety at each location. These are generally based on long-time averages (preferably covering ten years). The yields are in terms of cases of canned product. They thus include both green produce yields as well as plant yields. Historical results are adjusted for seed strain changes, agronomic changes, territorial shifts, factory changes and any other factors which may affect the normal yields at the location. Once the normal yields are agreed upon, they become the budget yields for the location for a year. Ordinarily, the normal green produce yields used for the budget do not change a great deal from one year to another except upon introduction of new seed strains. Plant remodelings may affect the recovery from processing and, therefore, change the normal yields.

After the planting season is completed early in June, the actual acres planted times the normal or budgeted cases per acre gives a revised budgeted pack at each location. Actual acres planted are used, rather than the budgeted acres as changes in plans do occur after the budget is completed. Growers may cancel contracts at a time when it is too late to obtain new contracts or to increase the farming program. This may cause acreage shifts between plants. Certain varieties of seed may not be available in anticipated quantities and changes must be made. Rather than penalize a plant for such uncontrollable factors, we adjust to the actual planted acres but we stick to the budget yield in terms of cases per acre, in obtaining normal pack.

With the exception of field overhead, all overhead costs are allocated on this budgeted production, factory overhead to commodities and division overhead to plants. Field overhead costs are allocated on an "acre planted" basis. At this point the overhead costs are budgeted amounts, but the same allocation factors are maintained and used at the end of the year when the actual amounts are known.

It should be noted, as the discussion proceeds, that every attempt is made to assign overhead costs which pertain only to one product directly to that product. Some plant machinery, for instance, is used exclusively for one product. Repairs and depreciation on this equipment are assigned to the proper product and do not enter into the allocation procedure. The same applies to some field machinery, such as harvesting equipment. The allocation procedure is used only for overhead expenses which are joint costs.

An Illustrative Overhead Problem

A simple illustration will show the effects of the change in the method of overhead allocation from the actual units of production to the budgeted volume, when there is a significant variation in yield. Let us assume we have budgeted an equal production for each of two products and, although we get a seventy-five per cent yield of Product A and 125 per cent yield of Product B, the total actual combined production is the same as the total budget. Assuming the amount of overhead expense to be the same as budgeted, an allocation on basis of actual production would result in:

1. A 25 per cent reduction in overhead charged to Product A and a 25 per cent increase in overhead charged to Product B.
2. An overhead cost per unit exactly as budgeted.
3. An equal overhead cost per unit for each product.

On the other hand, allocation of overhead on the basis of budgeted production would produce the following:

1. The same total amount of overhead charged to each product as was budgeted (which was the same amount for each product).
2. An increase in the overhead cost per unit for Product A (33 1/3 per cent over budget) and a decrease in overhead cost per unit for Product B (20 per cent under budget).

If we further assume that the budgeted overhead represented 25 per cent of the budgeted total cost of each product and that actual direct costs were the same as budgeted, allocation of overhead on the budgeted production basis would produce a total unit cost of 108 per cent of budget on Product A and 95 per cent of budget for Product B. Total dollar cost for the two products combined remains the same as budgeted, provided unit direct costs for each product were equal, but there is a large difference in the cost assigned to each product and in the resulting margin of each product.

In a practical sense, the problem is even greater than shown by the illustration. In practice, Product A would be canned and a large proportion shipped prior to the start of packing operations on Product B. By the time pack of Product B was completed, Product A could be more than 50 per cent shipped. Under such conditions, it is unnecessary to point out the problems involved in explaining such a change in margin estimates to

management in terms of changes in absorption of overhead. Under the previous system any resemblance in margin estimated in the preliminary reports issued after the pack of product A was completed and margins in those issued at a later date was certainly accidental.

The problem was not one of estimating total overhead costs but of changing their allocation to products. The allocation factors were not known until late in the fall. Cost reports on Product A were meaningless at the time as changes could no longer be recovered through additional sales values. Under the normal production allocation basis the only problem involved is the accuracy of the overhead expense estimates. Although this brief discussion has been limited to the total company production cost of two products, the same problem exists in greater or lesser degree when estimating individual plant or division margins.

Application of the Method to Planning

From the previous discussion it would appear that the revised procedure was designed primarily to make the accounting department's reports more consistent and more easily understood. This certainly was an important factor when the change was first made. However, there are some interesting theoretical aspects to the normal production allocation method which are worthy of further elaboration. We have a certain investment in plant facilities, capital equipment, factory supervision, general and administrative staffs, etc., which must be recovered through production at each location. This investment was predicated initially on a normal volume of production at each of these locations. In the planning stage, we may have several choices for recovery of this investment. Once a certain plan of action is decided upon, however, and the crop is in the ground, there is no turning back. The investment must be recovered through the planned pack established for that location. If this plan calls for recovery of one-half of the investment from each of two products, it seems incongruous to charge one product more than its proportionate share merely because production of the other product was below normal expectations. Similarly, if one plant experiences below normal yields, it seems unjustified to penalize another plant for this.

The annual cost of supervision, office expense, communications, property taxes, production machine rentals, etc., do not vary a great deal, regardless of the size of the crop. Depreciation of equipment is caused by obsolescence as much as it is by wear and tear. The annual repair budget is approximately the same from year to year. Charges by cost centers for repairs are made against the following year's operation rather than against the preceding year's. Again we feel

it is more equitable to base these charges on a normal rather than actual production basis.

Application of the Method to Alternative Decisions

Our general theory of operations is to make each plant an autonomous unit. Even though our company is a multiplant operation, we like to think of each plant as a separate factory. For this reason, we feel justified in assigning a portion of selling expense, interest expense and general administrative costs against that plant's expected normal production. Even though that plant does not experience normal yields, it still must stand its portion of these fixed overhead costs. If this plant were independent, it would need to maintain its own sales force, finance its pack and bear its own administrative expense. Thus, we do not feel that it is unfair to assign a predetermined portion of these costs against it, as a fixed cost regardless of production.

This same general philosophy applies throughout our overhead distribution. Circumstances do occasionally arise which appear to make this policy seem rather arbitrary. Sometimes yields are so poor and two plants are so near together that it is to the company's advantage to close one plant rather than run two plants at half capacity. The plant with the lower operating costs is, of course, the one which continues to operate, even though it may have the higher fixed costs. It is admittedly difficult to explain to a plant manager why he should continue to stand a portion of the general overhead when his ability to produce is being transferred to another plant. As a company policy he can see the over-all savings effected by transferring the green produce.

Sometimes we can show him that he would actually be losing the greatest portion of this fixed overhead charge if he operated at fifty per cent of capacity. At the same time, he is participating in increasing the over-all company margin. We feel that, if this is a recurring situation in this plant, it should be reflected in this plant's margin contribution. Possibly the entire program should be reviewed to determine whether or not the plant should be operated. Ordinarily, if the yield situation is so bad that a plant is closed down entirely for the season, everyone realizes the effect on plant margins, and the plant is not criticized too severely.

Advantages and Requirements of Normal Production Burden Basis

The basic reason for application of any and all overhead costs is to arrive at a total cost for that product or service. Does the method outlined achieve this result? How are the results accepted in practice? Which method provides the most accurate total cost? The theoretical aspects have been outlined. In practice too,

the normal production allocation method provides a more realistic cost picture in a highly competitive industry. Yields for the entire industry are just as variable as for our company, as we are scattered geographically like the rest of the industry.

In years of poor yields, it is easier, through the normal production allocation method, to recover the additional overhead through increased sales values. In years of above normal yields, our products can use any overhead advantage which can be assigned to them. The product with the high yields should benefit through reduced overhead costs per unit, which result from the method used, rather than have a larger dollar charge assigned because of the circumstance of high yield. It is almost impossible for Product B to recover under-absorbed overhead on Product A in years when Product B has above normal yields. For this reason, it is believed that the normal production allocation method provides a more realistic and more useable cost than actual production as a distribution base.

The prerequisites for this type of overhead distribution are several. First of all, a good reliable operating budget is an absolute necessity. Normal production figures must be realistic and understood by everyone using them. The planned program, as outlined in the budget, must be in conformity with management's own plan. It must be management's budget. I believe the program has most merit where production is highly seasonal and volume of production is highly variable, due to conditions beyond human control. Some control over the raw materials is desirable. The program might be more difficult if raw produce were purchased on the open market. We have a measure of control through contracts with growers and our own farming operations.

I have long been convinced that no uniform method of overhead burden application is possible for all industries or even for all companies within an industry. Each firm must choose the method which best fits its type of operations. Very little has appeared in the accounting literature concerning the problems of seasonal industries in general, and the canning industry in particular. It is hoped that this discussion may stimulate others to present their problems and solutions.

THE COST FORUM

WHY INVENTORIES?—A RAFT OF REASONS

Editor, N.A.C.A. Bulletin:

PROPER INVENTORY PLANNING DECIDES, to a great extent, whether the business will operate or not, today and tomorrow. Hence, properly controlling inventory size is one of the most important phases of business management. All accountants have read that inventories are the "graveyard" of American business because they have been the prime factor for many business failures. Items of great physical size with small value, cost much more than their value in storage facilities and in handling costs. Items of small size but great value tie up working capital. Many companies reach the ultimate when they have items of large size and value. Nevertheless, inventories are necessary. Why?

We have stockpiling of materials for various protections, including protection against scarcities. This requires some "crystal ball gazing," as well as review of current trends and information concerning the production of such required raw materials. Where supply lines are long and a slight break in such lines would create shortages, it is quite necessary that stockpiling be done. A good example of this is a public utility company stockpiling coal in the event of long drawn out labor problems in the coal industry and the probability of bad weather conditions affecting their supply. Other causes of stockpiling are inability to anticipate customer demand, maintenance of production to stabilize employment, and speculative buying.

Relatively large in-process inventories are inevitable when the manufacturing cycle is long. Many companies increase their in-process inventories to minimize the effects of production line changeovers. Some build up parts and sub-assemblies and others will build up finished goods in warehouses prior to making switches in their processing lines.

Customer service requirements tend to increase finished good inventories. Need for rapid deliveries may require a full line of stock in all sizes, grades, colors, etc. It is sometimes necessary, for competitive and sales reasons, to warehouse merchandise throughout the country in order to meet demand. An alternate to this is the inventory which is created from consignments to dealers. Also, guaranteed returns may be a historical practice and, while the materials move into accounts receivable, it is very possible that they may revert to inventory at a later date. Some manufacturers and many retailers tie up inventory for demonstation or show.

Carrying repair parts, both for current and obsolete models, can create inventories, too. The other day, I was amazed in observing in a radio and television service store the tremendous stock of small to minute parts which is carried just so "television viewers" will not have to miss more than one show.

Other inventory-creators are the industries subject to seasonal and unpredictable demand or to the weather conditions. In the latter industry, inventories cannot be built upon day-to-day weather predictions, but must be based on averages, with a factor of safety. Then there are the holiday industries which, not only produce for the normal holiday sales but try to create some of their own. We have Sweet-

est Day, Mothers' Day, Mothers-in-law Day, Grandmothers' Day, etc. In the automotive industry, inventories are created by new model anuouncements and, in many other industries, new models or new products cause inventories to be created. The canning industry is dependent entirely upon seasonal production. For instance, the work in a tomato canning factory in September is short-lived. Many canning organizations buy tomatoes long before the vines have even been planted and their inventory problems come from both supply and demand, all created by Old Man Weather.

ROBERT K. ARTHUR, *Dayton Chapter*

WE FIND PERPETUAL INVENTORY FOR OFFICE SUPPLIES WORTHWHILE

Editor, N.A.C.A. Bulletin:

HAVING ADOPTED perpetual inventory records for our noncapitalized office supplies about a year ago, we were greatly interested in Herman A. Downs' paper entitled "A Workable System For Office Supplies published in the May 1953 issue of the *N.A.C.A. Bulletin*. The author expressed the opinion that the maintenance of perpetual inventory records for noncapitalized office supplies was not justified.

Our office supplies inventory is composed of approximately 1,700 different items including a wide diversity of forms, consumed by approximately 300 office employees and draftsmen. About one hour a day is required to post an average of 50 entries to the inventory cards. Postings are kept to a minimum by issuing at least one week's supply of regularly used items and authorizing only one person besides the supervisor in each department to prepare requisitions. Interference with handling mail and other duties in the department is kept at a minimum by limiting distribution of supplies to specified time.

Prior to the installation of perpetual inventory records, office supplies were recorded upon visual observation of low physical balances. Occasionally, reordering was not in time to prevent "run-outs." However, since the adoption of the perpetual inventory records, we have yet to experience a "run-out" on any item.

Our perpetual inventory record card looks like this:

ITEM LOCATION REORDER POINT REC. & ISSUING UNIT REORDER QUANTITY			
Date	P. O. or Dept. No.	Quantity Received	Balance on Hand

Provision is made for the reorder point and reorder quantity for each item. As requisitions are posted and new balances calculated, the posting clerk compares the new balance with the reorder point. When the balance on hand equals or falls below this point, the item is reordered in the quantity specified.

Reorder points and reorder quantities are carefully set for each item and are subject to periodic review and adjustment in the light of current and future needs and advantageous purchase prices. However, increasing reorder quantities for the purpose of taking advantage of quantity discounts is not permitted to an extent which result in increase of inventory beyond reasonable future needs. In general, we order a six months' supply whenever practicable.

It is felt that the perpetual inventory system results in better control of reordering than any system which is based upon visual observation of physical balances for the following reasons:

1. *Reordering Signals*—Visual marking of minimum physical quantities is dangerous since such markings can become obliterated, misplaced, or detached, depending, upon the method used. Continual checking by an experienced clerk is thus

necessary. In contrast, comparison of written reorder points against calculated balances on hand can be performed by anyone who can add and subtract.

2. *Analysis of Departmental Usage*—Departmental usage of a given item or group of items of supplies can more readily be ascertained from one card containing a record of all requisitions than by inspecting and sorting the entire requisition file.

3. *Slow-Moving Items*—As we endeavor to keep the inventory free from slow-moving items as much as possible, we find that a record of usage on one card is also very convenient for this purpose.

4. *Inventory Consciousness*—Perhaps the outstanding benefit arising from the perpetual inventory system is the alertness which has been created in the employees associated with it, as evidenced by the physical appearance of the office supplies stock room and the complete elimination of "run-outs." The later objective was the major purpose of adopting the perpetual inventory system.

W. F. MUSSENDEN, *Southern Maine Chapter*

UNIT COST WHEN PRODUCT IS RUN ON EQUIPMENT OF GREATER AND LESS EFFICIENCY

Editor, N.A.C.A. Bulletin:

AT ONE TIME OR ANOTHER most of us have coped with the problem presented when an item is produced on different equipment at different unit costs. Three common cases are as follows:

1. *Lowest cost equipment too big.* The most frequent situation is that a production manager has a choice of assigning a job to a unit of high speed or large equipment, or of putting it on slower or smaller equipment units. There are also situations in which the manager may face an alternative of having jigs made, or of procuring certain automatic devices for turning out goods of certain descriptions and sizes. In all of these situations, the main point under consideration is usually the volume of the production run. The choice made will, as a rule result in the lowest total cost for the production lot, although the unit cost is not as low as it would be for a larger run. However, no unusual problems of costing arise since the most efficient production methods were employed for the particular volume.

2. *Most suitable equipment tied up on other work.* A somewhat different situation results if the products are made on higher cost machines because the most suitable equipment was scheduled on other work. In this case, there is a real question whether the products should be charged with the production cost on the machines actually used or with the operating cost on the more efficient equipment. In most standard cost systems, this problem is settled by applying only the standard costs for the most suitable equipment and treating the difference as a variance. In this case, the period absorbs the excess cost, and costing for both pricing and inventory is based on standard costs. This seems correct practice. It discloses the deviation from standard which occurred on the production floor, and yet reflects the costs which must be the basis of pricing under competitive conditions. Of course, under shortage conditions it is possible that the seller can include the extra cost in his price.

3. *Lower cost and higher cost equipment regularly used.* Another case is the situation in which a company regularly produces an item on equipment operating at different unit costs. Are we still justified in either a standard or an actual cost

system in setting up the entire production at the lower cost of the two processes or locations?

Presumably, the answer is that we should take the cost of both operations into account. After all, if our volume did not require the regular use of the higher cost facilities along with the lower cost installation we would concentrate our production on the latter. Therefore, correct practice requires using the costs of both processes, even as standard costs, and of including them proportionately in the inventory values. It would seem wrong to charge the excess cost to the period in which the cost was incurred, since the production was in accordance with plan and it must be assumed that the production was required to meet market demand at regular prices.

In practice, we are likely to carry the production from both sources in one stock account. In that case, we automatically arrive at a weighted average. If we maintain separate stock accounts, we probably also maintain physically separated stocks, most likely at different locations. Each lot will then be costed on the basis of its origin.

It appears that the use of higher cost equipment and processes should generally be reflected in costs and inventories. This applies if we use such equipment because of the small size of the run, although we would not recognize the higher cost if we produce a standard item in an unusually small lot. We would also reflect the higher outlay if both higher cost and lower cost processes on a considerable scale are part of the regular production program. However, he would charge the excess cost to the current period if the higher cost is due to the intermittent use of less suitable equipment while the better equipment is engaged on other work.

FRANK JUDD, *Louisville Chapter*